

DOCTORAL THESIS

The interaction between music and language in learning and recall in children with autism spectrum condition

Reece, Adam

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**The interaction between music and
language in learning and recall in children
with autism spectrum condition**

by Adam Reece BA, MSc

**A thesis submitted in partial fulfilment of the requirements for the degree
of PhD**

School of Education

University of Roehampton

Abstract

A study was carried out to examine the interaction between music and language in learning and recall in children with autism spectrum condition (ASC). The research comprised initial interviews (N=12), a questionnaire (N=320), and a comparative intervention with children with ASC (N=24), and a comparison group of neurotypical individuals (N=32). Results from the questionnaire showed that, in the view of parents and teachers, there was a high prevalence of singing amongst children with ASC, especially in those with language delay. Furthermore, in the view of parents and teachers, music was more likely to enhance relationships for children with some language delay (as opposed to children who were non-verbal and children with age- appropriate speech).

In the practical phase of the study, where children were asked to learn and subsequently recall both spoken and sung material, it was found that singing as opposed to speaking could enhance verbal recall for some children with ASC - particularly those with some language delay. With regard to the effects of language on melodic recall, for children with the lowest levels of musical development, the presence of language had a positive effect, but as the level of children's musical development increased, the impact of language on melodic recall diminished. With regard to the comparison group, for children at Key Stage 1 (5-7 year olds), music had a positive effect on verbal recall in the long term, but for children at Key Stage 2 (8 -11 year olds), music had a negative effect, although this may have been due to external factors.

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In memory of my late father Lawrence Reece (1929 - 1983)

Chapter 1: Introduction

1.1 Reasons for carrying out this research

1.1.1 From 2005 – 2008 I studied for an MSc in learning disabilities at the University of Manchester. One module during my first year was entitled, ‘Health and Leisure for Individuals with Profound and Multiple Learning Disabilities (PMLD).’ From the list of recommended reading, I looked up an article entitled ‘Music in the Education of Children with Severe or Profound Learning Difficulties,’ written by Professor Adam Ockelford, and first published in *Music Psychology* in 2000. In the article, Ockelford proposed that the provision of music within the context of special needs education could be conceptualised as comprising two distinct strands:

- 1) Music for its own sake.
- 2) Music to inform wider learning.

1.1.2 I had never really considered the notion that children’s engagement with music was for anything other than intrinsic reasons, and I was thus intrigued by the suggestion that music could somehow enhance cognition and that, furthermore, it was possible to explore this process empirically. I therefore began to research the more general areas of ‘music and cognition’, looking to understand and evaluate the ways in which exposure to music may impact on cognition specifically for individuals with learning disabilities.

1.1.3 Inspired by Ockelford’s 2000 article, for my dissertation I conducted a single case-study on the effects of music on cognition for a young person with PMLD. The

results provided evidence to suggest that the presence of music had an enhancing effect on concentration and Joint attention.

1.1.4 On completion of my MSc I began work as a healthcare worker, supporting individuals with Autism Spectrum Condition (ASC) in various special schools, day care centres and sheltered living accommodation. I would often play the piano or, in the absence of a piano, an electric keyboard. I recall three specific occasions that fired my enthusiasm for undertaking the research set out in this thesis.

1.1.5 One evening, working in sheltered living accommodation for individuals with learning disabilities, I set up an electric keyboard and began playing music for some of the residents. Whilst playing some well-known standards from the *American Song Book*, I noticed that one man diagnosed with ASC was singing very quietly, or at least mouthing all the words to a lot of the standards I was playing, including songs such as Bart Howard's *Fly Me to the Moon*, and the Cole Porter classics, *Night and Day* and *Got you Under my Skin*. At the time I did not think that this was anything particularly worthy of note, although after I had finished playing, a nurse came up to me and said that, in eleven years of knowing the resident, this was 'the most animated' she had ever seen him. Much of the time he was allegedly 'non-verbal'.

From this experience I was intrigued to know why exposure to such music had this effect on the man in question. Were the lyrics bringing back memories? Was it the melody? Was it the context in which the music was being played? So many questions remained unanswered and, ultimately, I was left wondering: Could this happen again in another context? With another person? With another genre of

music? Certainly I had never experienced anything like this, and I wanted to know whether exposure to music might have as powerful an effect on other people, in different situations and under different circumstances.

- 1.1.6 On another occasion, I was working at a Special School in Cornwall, trying to encourage the children to take part in musical activities, either through singing or by playing an instrument. I worked with the pupils either on a one-to-one basis or in small groups. One of the children I worked with, who was diagnosed with ASC, had extremely limited linguistic abilities. But he loved music and seemed extremely enthusiastic when involved in singing. The first time I met him I was playing '*Three Little Birds*' by Bob Marley on the piano. The hook of the song is 'Don't worry about a thing, 'cos every little thing's, gonna be all right'
- 1.1.7 By the end of the session the child was very happily singing or mouthing the words to the hook of the song. The following week, on the same day at the same time, the child arrived for a further session; he remembered the hook to the song and sang it to me perfectly. During that session I played *Imagine* by John Lennon and *Angels* by Robbie Williams. Again the child mouthed the words and sang along. The following week, he demonstrated that he had remembered all the words and could sing them back to me without any mistakes. I was fascinated by how a child who had been described to me by one teacher as 'virtually non-verbal' had the capacity to learn these lyrics, remember them, and then sing them back to me one week later.
- 1.1.8 At the same school there was another child diagnosed with ASC who, again, had been described by some teachers as 'mostly non-verbal.' I worked with this child for

several weeks, and it became clear that he had a great enthusiasm for Walt Disney DVDs. In particular he used to like *Dumbo*, especially the song *Elephants on Parade*. One week I played the song and then started to play it to him again during the next session. He turned to me and said clearly, in a lively and dynamic tone, ‘Hey, why don’t we sing *Elephants on Parade*?’ He proceeded to sing the song in tune. It struck me that it would have been hard to discern that this child had any language impairment at all. From these instances, and several more similar ones, I knew then that I wanted to focus my research on the impact of music on language for individuals with ASC.

1.2 Objectives of this research

- 1.2.1 According to Ball (2004: p.9), ‘Whether music therapy is better than other forms of behavioural therapy for children with autism is unclear. These conclusions are limited by the poor quality of the evidence, in particular the biased selection of the children, the small numbers involved, the “contamination” effect of the crossover design of many of the studies, the uncertain relevance of many of the outcome measures and the short follow up. Without further research, no recommendation about the clinical effectiveness of music therapy for autism can be made.’
- 1.2.2 The objective of this research is to ascertain the effect of music on language for children with ASC in a systematic way. My thesis is that singing (as opposed to speaking) will enhance verbal learning and recall for children with ASC.

1.2.3 The research comprised the following phases:

Study 1: Preliminary study: comprising 12 semi-structured interviews with parents, teachers, carers and music therapists.

Study 2: Questionnaire: completed by 320 respondents.

Study 3: Comparative Intervention: employing a practical intervention involving a group of 24 participants with ASC, and a comparison group of 32 neurotypical primary school children.

1.3 Hypotheses and Research Questions

1.3.1 My hypotheses for this research are as follows:

- The co-existence of music and words may facilitate language and music learning and utilisation for children with ASC.
- The effect will be more marked for children with ASC than for those developing neurotypically.

1.3.2 My research questions are as follows:

- Does the co-existence of melody with a string of words make the words easier to learn and reproduce for children with ASC?
- Does the co-existence of melody with a string of words make the words easier to learn and reproduce for 'typically developing' children?

- Does the co-existence of melody with a string of words make the music easier to learn and recall for children with ASC?
- Does the co-existence of melody with a string of words make the music easier to learn and recall for ‘typically developing’ children?

The structure of this thesis is broken down into the following sections. In chapter two the review of literature is carried out, and in chapter three the rationale behind the design of the research is expounded upon. Chapter four contains details of the semi-structured interviews carried out in the preliminary study. Chapter five contains a write-up of the questionnaire, and the comparative intervention is contained within chapter six. Chapter seven is a general discussion of how the findings from this study can be contextualised within similar research carried out in the field and, additionally, how the findings answer the research questions and confirm or refute the central hypotheses. Finally, suggestions are made pertaining to how future research within this field should be carried out.

Chapter 2: Review of Literature

2.1 Introduction

2.1.1 The potential of music to promote learning in other areas has intrigued researchers for many years, and over the last few decades evidence has been presented to show how music can enhance cognitive ability in terms of spatial reasoning (Rauscher and Shaw 1994) and social and communication skills (Edgerton 1994; Aldridge 1995; Wimpory 1999; Duffey 2000). Recent research has also provided evidence to suggest that some children with ASC have preserved or even enhanced musical abilities (Lim 2012; Ockelford 2008, 2013) and that the presence of music can augment language acquisition and use (Boso 2007; Lim 2011, 2013; Ockelford 2008, 2013). If language is a challenge for some children with ASC, and if these children show more advanced musical abilities than their neurotypical peers, might music be able to support language acquisition and use among children on the autism spectrum? In this chapter I will identify and discuss the literature that focuses on the impact of music on language for both typically developing individuals and those with ASC.

2.1.2 I start with a definition of ASC and the diagnostic criteria, and how memory and recall in ASC may impact upon language acquisition and use. We then consider how music ‘makes sense’ before finally looking at how music and language combine to impact upon communication.

2.1.3 In terms of the general population, two explanations have emerged with regard to why music may have a positive impact on language. These are arousal theory and shared neural resource theory. Referring to the ASC population, a third theory on why music may impact upon language pertains to the unique cognitive style attributed to individuals with ASC.

2.1.4 These three differing explanations of why music may impact upon verbal recall lie at the heart of my thesis. The theories are addressed in this review of literature to better understand the relationship between music and language, and how music may impact upon language for children with ASC.

2.2 Autism Spectrum Condition (ASC) – an overview

2.2.1 Early Definitions of Autism

2.2.1.1 Kanner and Asperger, working independently of each other in the 1940s, both used the term ‘autism’ to refer to cases involving children unable to establish normal relationships with their peers. In his paper of 1943, Kanner concluded that the five main features of autism are as follows:

- 1) The children’s difficulty in relating to other people.
- 2) Their failure to use language for the purpose of communication.
- 3) An anxiously obsessive desire for the maintenance of ‘sameness’.
- 4) A fascination for objects which were handled with skill.
- 5) Cognitive potential.

In a paper written 13 years later with Leon Eisenberg, Kanner stated that ‘the presence of elaborately conceived rituals together with the characteristic aloneness serves to differentiate the autistic patient’ (Eisenberg and Kanner 1953: p.5). They concluded that there were two key features to autism, both of which must be present in order to produce an accurate diagnosis. These two features are:

- (a) Extreme self-isolation.
- (b) The obsessive insistence on the preservation of sameness

2.2.1.2 Just a few months after Kanner’s original paper, in 1944 Asperger produced his seminal paper on autism. Asperger noted that the syndrome was very much more common in boys than in girls, and that it could not be recognised before the third year of life. Asperger considered the social prognosis to be generally good, meaning that most of his patients developed enough to be able to use their special skills to obtain employment. He also observed that some who had especially high levels of ability in the area of their special interests were able to follow careers in, for example, science and mathematics. Asperger (1944) considered the syndrome he identified to be genetically transmitted. There was no known organic pathology and, on psychological assessment, individuals performed well in tests for rote memory but less well in tests involving abstract concepts, or sequencing in time.

2.2.1.3 Wing (1981: p.18), who produced the first translation of Asperger's work in English, states that both Asperger's papers of 1944 and 1979 and Kanner's of 1943 show striking similarities between the children, in that

- both had an excess of males over females,
- both indicated social isolation, egocentricity and lack of interest in feelings of others,
- both included use of language in idiosyncratic ways,
- both showed impairment in non-verbal aspects of communication,
- both writers describe lack of imaginative play,
- both described a repetitive pattern of activities,
- both mentioned odd responses to sensory stimuli,
- both noted clumsiness in gait, yet enhanced dexterity in specific skills,
- both noted aggressiveness and negative attitudes to others,
- both noted uneven learning profiles with advanced abilities in rote memory and number tasks.

2.2.1.4 The main differences were as follows:

- children described by Asperger all developed language by school age,
- although socially isolated, they were not unaware of others,
- Asperger described children as odd-looking in appearance whereas Kanner often described an alert and attractive look,
- Asperger described and discussed clinical conditions and, unlike Kanner, did not compile a list of essential diagnostic criteria.

2.2.1.5 More recently, Wing's view was affirmed by Baron-Cohen (2008: p.13), who wrote that 'Classic autism and Asperger syndrome both share two key features: social communication difficulties and narrow interests and repetitive actions. Conversely classic autism and Asperger syndrome differ in that, in Asperger syndrome, IQ is at least average and there is no language delay. Moreover, in classic autism, IQ can be anywhere on the scale, and there is language delay.'

2.2.2 Contemporary thinking about autism

2.2.2.1 Contemporary definitions of autism, as set out by the World Health Organisation (WHO 1993) and the American Psychiatric Association (APA 2013), state that a diagnosis must include all three of the following criteria, which must have been present from childhood:

- 1) A qualitative impairment in social interaction
- 2) A qualitative impairment in communication
- 3) Restricted repetitive and stereotyped patterns of behaviour, interests and activities.

In the DSM-5 (Diagnostic and Statistical Manual of Mental Disorders, Fifth Edition) amendments of 2014, however, instead of individuals on the autism spectrum receiving a diagnosis of 'autistic disorder', 'Aspergers disorder', 'childhood disintegrative disorder' and PDD-NOS (pervasive developmental disorder not otherwise specified), they are now given a diagnosis of ASC (National Autistic Society: 2014). Additionally, the previous use of three areas of impairment has been reduced to two main areas:

- social communication and interaction

- restricted repetitive patterns of behaviours, interests or activities

- 2.2.2.2 In the last twenty years or so, different theories have been advanced concerning the causes of autism, which relate to one of the core impairments as defined by the DSM-5. With regard to ‘a qualitative impairment in social interaction,’ a defective ‘theory of mind,’ has been held responsible, in that an individual with ASC may have difficulties comprehending that another person may have a different state of mind to his/her own, or that another person may have differing ideas (Baron-Cohen 1995, 2000, 2009; Baron-Cohen, Leslie and Frith 1985; Tager-Flusberg 2001). According to Baron-Cohen (2008: p.57), a theory of mind is ‘the ability to put oneself into someone else’s shoes, to imagine their thoughts and feelings, so as to be able to make sense of and to predict their behaviour.’
- 2.2.2.3 ‘Weak central coherence’ - the tendency to process things locally as opposed to globally - has been considered to be the cause of ‘a qualitative impairment in communication’ (Frith and Happé 1994; Happé 1996; Happé and Booth 2008). According to Baron-Cohen (2008: p.52), weak central coherence occurs because ‘people on the autism spectrum have problems in integrating information to make a coherent, global picture. Instead, they are said to focus on the small, local details in a scene.’
- 2.2.2.4 Finally, ‘executive dysfunction’, a problem with the domain of processing that regulates and controls other cognitive functions (Hill 2004; South, Ozonoff and McMahon 2007; Turner 1997), has been seen as the cause of ‘restricted repetitive and stereotyped patterns of behaviour, interests and activities.’

2.2.3 Memory and recall in ASC

2.2.3.1 In recent years, models of memory in autism have proposed that the memory deficits are a reflection of core deficits in executive function (Bennetto, Pennington and Rogers 1996; Russel, Jarrold and Henry 1996) or of a basic deficit in the processing of complex information (Minsheiw and Goldstein 2001). The complexity of the to-be-remembered material appears to be an important factor that influences the memory performance of children with autism. Boucher (1981) reported that children with high-functioning autism remembered significantly less about recently experienced events than a neurotypical comparison group and a group comprising children with learning disability. She proposed that, as a result, children with autism may encode less information from a complex stimulus such as a social interaction or conversation. Visual memory for some types of material has been found to be an area of strength for children with autism, but complexity of the stimuli appears to affect memory function in the auditory modality as well.

2.2.3.2 In a similar vein, Fein (1996) reported that memory function in autism was characterised by a dissociation between intact memory for material with low levels of structure, and impaired memory for material with more complex levels of organisation; young children with autism had the least trouble with recall of digits, more trouble with sentences, and the most difficulty with stories. Furthermore, direct measures of verbal working memory, ones that use only a minimal processing load, have failed to confirm a deficit in this area in children with autism (Williams, Goldstein, Carpenter and Minsheiw 2005). This is of particular relevance to my research as, in the practical phase, participants will be tested on verbal recall in working memory.

- 2.2.3.3 Deficits in memory may emerge and become more pronounced with increasing cognitive load (Minshew et al. 1997). In a similar vein, according to Minshew and Goldstein (1998), the pattern of memory observed in children with autism can be conceptualised within the model of autism as a disorder of information processing that disproportionately affects complex information processing abilities. Put more simply, the more complex the task and the information being processed, the more taxed the resources of the memory system become.
- 2.2.3.4 This notion was reinforced by Minshew and Goldstein (2001), and Williams, Goldstein and Minshew (2005), who carried out a study to compare the auditory and visual memory of high-functioning adolescents and adults against group-matched neurotypical controls. Results, in accordance with previous research, provided evidence to suggest that, for the ASC group, basic associative memory abilities were intact, but that the use of cognitive mediating strategies to support memory was impaired. Furthermore, memory impairments grew progressively worse as the complexity of the material increased in both the auditory and visual modalities.
- 2.2.3.5 Later, Williams, Goldstein and Minshew (2006) carried out a study using the Wide Range of Assessment and Learning (WRAML) test. The WRAML contains tests involving immediate memory span, story recall, and associative learning. The Verbal Memory scale consists of a number/letter sequence memory task in which the child repeats a random mix of auditorally presented numbers and letters, a sentence memory task in which the child repeats progressively longer meaningful sentences, and a story recall task in which the child recalls details of two short stories that were read aloud. The visual memory scale assesses recall of geometric designs, picture

scenes, and sequences. The design memory subtest requires the child to draw one of four designs after a 10-second delay. In the picture memory subtest, the child views a complex meaningful scene, then looks at a second, similar scene and indicates what is now different. The finger windows task requires the participant to recall the sequential placement by the examiner of a pencil into a series of holes placed in a plastic card. The learning scale consists of a word list recall task, a sound symbol association task, and a design location recall task. Participants consisted of 38 high-functioning children with autism and 38 individually matched control participants between 8 and 16 years of age.

2.2.3.6 Results showed that the profile of memory abilities in children in the ASC group was substantially different from the profile found amongst the neurotypical children in the control group. The memory profile of the autism group was characterised by relatively poor memory for both complex visual (design memory and picture memory) and complex verbal (sentence memory and story memory) stimuli, with relatively intact associative learning ability (sound symbol), verbal working memory (number/letter), and recognition memory (story memory recognition score).

2.2.3.7 In a similar study conducted in the same year, verbal and spatial working memory was examined in high-functioning children, adolescents, and adults with autism compared to age- and cognitive-matched controls. No deficits were found in verbal working memory in the individuals with autism, although deficits were found in spatial working memory. The researchers believed that a greater understanding of the basis for the dissociation between intact verbal working memory and impaired spatial working memory and the breakdown that occurs in verbal working memory

as information processing demands are increased will probably provide valuable insights into the unique cognitive style employed by some individuals with ASC.

2.2.3.8 Bowler, Limoges and Mottron (2009) were interested in the extent to which verbal recall was impaired or intact in individuals with ASC. They carried out a study incorporating the Rey Auditory Verbal Learning Test, which requires the free recall of the same list of 15 unrelated words over five trials. The test was administered to 21 high-functioning adolescents and adults with ASC and 21 matched typical individuals. The groups showed similar overall levels of free recall, rates of learning over trials and subjective organisation of their recall. However, the primacy portion of the serial position curve of the ASC participants showed slower growth over trials than that of the neurotypical participants. In other words, improvement in memory of the first words on the list was evidently slower for the ASC group than for the control.

2.2.3.9 In an attempt to explain the results, the researchers believed that the participants with ASC appear to ‘work backwards’ from the last-presented item, rather than processing the material in a way that promotes preferential learning of the latest- and earliest-list items at the expense of those in the middle of the list. They believed that individuals with ASC may not semantically recode information in working memory in the same way as typically developing individuals, and this would explain why material to be remembered may not be transferred to longer-term memory. Instead such individuals rely more on the perceptual aspects of the studied material, and this could be the reason why the primacy portion of the serial position curve showed slower growth over the trials.

2.2.3.10 In this way, such an account is also compatible with the enhanced perceptual functioning theory of Mottron et al. (2006), discussed below, which has implications for how individuals with ASC may process music atypically. This is particularly important in the current context since, if the hypothesis that the co-existence of music and words may facilitate language learning and utilisation for children with ASC is confirmed, the enhancing effect of music on language might be explained by the unique cognitive style employed by individuals with ASC, in that perceptual processing or low-level processing is enhanced.

2.2.3.11 Jones et al. (2011) carried out a study to examine ‘everyday memory’ in individuals with ASC. Everyday memory is conceptualised as memory within the context of day-to-day life and, despite its functional relevance, has been little studied in individuals with ASC. In their study, 94 adolescents with ASC and 55 neurotypical individuals completed measures of everyday memory from the Rivermead Behavioural Memory Test (RBMT) and a standard word recall task (Children’s Auditory Verbal Learning Test-2: CAVLT-2). The ASC group showed significant impairments on the RBMT, alongside impaired performance on the CAVLT-2. The fact that the children with ASC showed significant impairment on the CAVLT-2 is of particular relevance to my research as, in the practical phase, children with ASC were asked to recite back words from a simple children’s song in a words-only condition, and a words-and-music condition. They were tested for their ability to recall the words immediately (thus investigating verbal recall in working memory) and again after a period of one week (investigating verbal recall in long-term memory). If participants recalled more words in the words-and-music condition, this

provided evidence that the presence of music can counter the impairment in verbal learning that some children with ASC experience.

2.2.3.12 According to the Task Support Hypothesis (Bowler 1997), individuals with ASC perform more similarly to their typically developing peers in learning and memory tasks when provided with external support at retrieval. To test the validity of this hypothesis, Phelan, Filliter and Johnson (2011) conducted a study where 15 high-functioning and a comparison group of 15 neurotypical participants had to recall a list of words from the Californian Verbal Learning Test – Children’s version (CVLT-C) designed by Delis et al. (1994). The CVLT-C involves the administration of a shopping list (List A) that contains fifteen items representing three semantic categories (things to wear, things to play with, and fruit). The most typical exemplars (e.g. apple for the fruit category) are excluded from the CVLT-C word lists to decrease the probability of correctly guessing items.

After each of five initial List A repetitions, participants were asked to repeat as many items as they could remember, in any order, to enable the researchers to assess immediate free recall. Following this, a distractor word list (List B) was presented to the participants once and immediate free recall of List B was completed. After this short delay, both free and cued recalls of List A were evaluated. For the cued recall trial, participants were required to recall words based on a category cue (e.g., ‘Tell me all of the words from the first list that are things to play with’). Free recall, cued recall, and recognition of List A were also assessed after a delay of approximately 20 minutes; to assess recognition, the examiner reads a list of words and asks the child to indicate whether or not the item was part of List A. In total, free recall was assessed seven times and cued recall was assessed twice.

2.2.3.13 Results showed that free recall in young people with ASC, but not comparison participants, improved with semantic cueing. When free and cued recall scores were compared, only the ASC group benefited significantly from the presence of external cues. The comparison demonstrated no such effect. The researchers believed that their finding supported the Task Support Hypothesis put forward by Bowler et al. (1997). This is important because, again, such a finding has important implications for how some children with ASC may process verbal stimuli in a unique way, in that impairment may occur through a process of retrieval as opposed to storage. The extent to which verbal impairment is dependent on retrieval as opposed to storage may help to provide new insights into the relationship between verbal and musical processing in children with ASC.

2.2.3.14 Conclusion

In this section we have discussed how some aspects of memory and recall may be different for individuals with ASC. The key findings are that the complexity of the to-be-remembered material appears to be an important factor that influences the memory performance of children with autism. Furthermore, children with ASC may rely on more perceptual aspects of the studied material (Mottron, Peretz and M  nard 2000). Finally, findings from research suggest that free recall improved with semantic cueing in young people with ASC, but not for a neurotypical comparison group, as only the ASC group benefited significantly from the presence of external cues when free and cued recall scores were compared. We now turn to language processing in ASC to ascertain whether the unique ways in which individuals may process language affect the way music impacts upon language for this population.

2.3 Language Processing in ASC

2.3.1 Autism and language impairment

2.3.1.1 Children with ASC have a wide range of linguistic abilities, from non-verbal to age-appropriate. As Baron-Cohen states (2010: p.109), ‘In classic autism there is invariably language delay, whereas in Asperger’s Syndrome, IQ is at least average and there is no language delay.’ I will later argue that the level of linguistic ability of a child with ASC is an important variable with regard to the impact of music on language for such children. Kanner (1943) originally summarised the linguistic characteristics displayed by children with autism: muteness, repetitions, immediate and delayed echolalia, pronoun reversals, word substitutions, and literalness (1943: p.143). Other atypical features of language use often associated with ASC include articulation, word use, syntax and echolalia, as discussed below.

2.3.2 Articulation

2.3.2.1 There is a range of views amongst researchers with regard to articulation and ASC. Among children with autism who speak, Pierce & Bartolucci (1977) and Kjelgaard & Tager-Flusberg (2001) found that articulation may be normal or even precocious. In contrast, Bartak, Rutter and Cox (1975) found articulation development to be somewhat slower than normal. Similarly, Bartolucci, Pierce, Streiner and Tolkin-Eppel (1976) showed that phoneme frequency distribution and the distribution of phonological error types in a small group of children with autism was similar to that of learning-disabled and typical children matched for non-verbal mental age.

2.3.2.2 Shriberg et al. (2001) reported that 33% of individuals with high-functioning autism and with Asperger’s syndrome retained residual speech distortion errors on sounds

such as /r/, /l /, and /s/ into adulthood, whereas the rate for the general population is just 1%.

2.3.3 Word Use

2.3.3.1 Tager-Flusberg (1991) found that the children with ASC participating in a longitudinal language study used hardly any mental state terms, particularly terms for cognitive states (e.g., know, think, remember, pretend). These findings were replicated in research including older children with autism (Storoschuk, Lord and Jaedicke 1995; Tager-Flusberg and Sullivan 1994).

2.3.3.2 Other studies suggest that children with autism have particular difficulties understanding social-emotional terms as measured in vocabulary tests such as the Peabody Picture Vocabulary Test (Eskes, Bryson and McCormick, 1990; Hobson and Lee, 1989; Van Lancker, Cornelius and Needleman 1991).

2.3.4 Syntax

2.3.4.1 There has been little research carried out with regard to the grammatical aspects of language acquisition in autism. The findings of Tager-Flusberg's study (1990) suggested that children with ASC follow the same developmental path as an age-matched comparison group of children with Down syndrome who were part of the study, and also the same as normally developing children drawn from the extant literature (Tager-Flusberg *et. al* 1990). The children with autism and Down syndrome showed similar growth curves in their Mean Length of Utterance, which is usually taken as a hallmark measure of grammatical development. Subsequently, Flusberg (2004) carried out a study in which over 60 children with autism were

given tasks to elicit both the past tense and the third-person present tense. The sample was divided into those who had scores within the normal range on standardised language tests and those who were significantly below the mean. Only those with impaired language scores performed poorly on the tense tasks. Across these studies, the marking of tenses was impaired among children with autism. Roberts et al. (2004) interpret their findings as evidence that a subgroup of children with autism have grammatical deficits that are similar to those reported among children with specific language impairment.

2.3.5 Echolalia

- 2.3.5.1 Echolalia, according to Fay (1967: p.245), is generally defined as the meaningless ‘repetition of a word or word group’ just spoken by another person. Echolalia can occur immediately after another person has spoken, or after an unspecified period of time (Lord and Paul 1999; Prizant and Wetherby 2005; Rydall and Prizant 1995). Hayoung Lim, Director of Graduate Studies in Music Therapy at the Sam Houston State University, specialised in research focusing on the influence of music on speech and language development in children with ASC. She states that immediate echolalia must follow within at least two turns of the original production, and must contain minimal structural change (Lim, 2012: p.41). ‘Delayed’ echolalia is repeated at least three turns following the original utterance, although this can sometimes occur days, weeks or even months later. Echolalia is characteristic of at least 85% of the children with ASC who acquire speech (Prizant 1987; Rydall and Prizant 1995).
- 2.3.5.2 In the past, researchers have advocated the replacement or extinction of echolalia through the use of behavioural modification procedures (Lovas 1977). Other

researchers have seen echolalia as a ‘pathological behaviour that could interfere with cognitive and linguistic growth’ (Screibman and Carr 1978). Some researchers, however, have looked at echolalia in a more positive light, attempting to describe the ‘functions’ of echolalia with regard to the impact it may have on cognition, communication and linguistic ability. Prizant and Duchan (1981) carried out a multilevel analysis of over 1000 utterances of echolalia from four children with ASC. Their results suggested that 67% of all utterances of echolalia from the children were produced with evidence of comprehension. Furthermore, they identified six separate communicative functions of immediate echolalia: turn-taking, assertions, affirmative answers, requests, rehearsal to aid processing and self – regulation.

2.3.5.3 Prizant (1983) proposed a four-stage process of language acquisition to illustrate how echolalic speech can evolve into functional language for children with ASC. The first stage involves ‘echolalia’, which Prizant believed may fulfil the role of understanding the role of turn-taking in natural conversation. The second stage involves a link between echolalia and other experiences and, thus, a connection is established. In the third phase, ‘echolalia needs to be shaped by modification of speech patterns towards more flexible and spontaneous speech.’ In the final stage, functional and spontaneous speech is accomplished. Prizant believed that the transition of echolalia to functional and spontaneous speech was along the lines of a continuum, without lines of clear demarcation.

2.3.5.4 Ockelford (2013: p.241) asserts that echolalia is a feature of normal language acquisition in children aged between one and two years, ‘when the urge to imitate

what they hear outstrips semantic understanding'. He cites an example whereby, if somebody were to repeat a phrase to you in a foreign language that you did not understand, and you were not allowed to indicate that you did not understand the phrase, 'you have little alternative but to punt the phrase or at least part of it back.'
(2013: p.239)

2.3.5.5 Conclusion

In this section we have reviewed the atypical ways in which children with ASC may use language, with respect to articulation, word use, syntax and echolalia. Research has provided mixed findings with regard to the abilities of children with ASC to articulate spoken verbal material. With regard to word use, research suggests that children with autism have particular difficulties understanding social-emotional terms. As far as syntax is concerned, it appears that children with autism have grammatical deficits that are similar to those reported among children with specific language impairment. Finally, findings from recent research suggest that echolalia may sometimes be functional and a precursor to normal speech.

Having briefly discussed some of the idiosyncratic features of language and language development in individuals with ASC, to further understand the complex relationship between music and language and how music may impact upon linguistic ability for children with ASC, it becomes necessary to discuss the atypical ways in which some children with ASC understand and process music.

2:4 Music Processing

2.4.1 How music makes sense

- 2.4.1.1 We turn first to music and how music makes sense, before considering how musicality develops in both children with ASC and their neurotypical peers. Ockelford (2013) contends that music is easier for the brain to grasp than language because it demands less processing. Music is ultimately about the perceptual differences and similarities between sounds.

‘Music is a special kind of language, but instead of having words it has notes. Notes don’t generally *mean* anything in the way that words do, pointing the mind to things beyond themselves. Rather, notes just ‘point to each other’: and the meaning of music is in these abstract relationships that we hear between sounds- usually without making any conscious effort.’ (Ockelford 2013: p.16)

Conversely, in language there is a requirement to link chunks of sound (i.e. words) with concepts from other sensory domains such as touch, smell, vision, or abstract thoughts; thus, the contention is that music is easier for the brain to process than language.

- 2.4.1.2 Ockelford (2013) contends that all musical structure ultimately stems from repetition and, as will become clear, that is why it may be important for some children with ASC. In an attempt to explain how music ‘makes sense’, in the 1980s Ockelford formulated his ‘zygonic theory.’ In describing zygonic theory Ockelford states that,

‘Although originally conceived as a system through which musicologists could analyse the structure of pieces in an academic way, it has proved a valuable tool in

trying to understand how music makes sense to all of us, and as we shall see, is particularly good at explaining how some children with autism may process music: indeed, the theory could have been constructed with them in mind.’ (2013: p.65)

2.4.1.3 Zygonic theory predicts that music makes sense through a feeling of derivation of one musical event from another (which stems from imitation) and that, as a consequence, repetition in music is pervasive (Ockelford 2008: p.64). Zygonic analyses have shown that ‘every aspect of music is saturated with repetition in a way that goes far beyond the motivic and thematic replications and variations that traditional music analysis seeks to identify’ (Ockelford 2008: p.65). This may be important for children with autism because of their love of pattern and repetition, and their superior perceptual processing abilities. Trevarthen (2009: p.386) suggests that music is a natural part of all development and an essential precursor to speech and language. Without it, it seems likely that speech and language would not develop. Hence, as many autistic children are echolalic, it would be logical to assume that they are functioning at an earlier development level, as far as linguistic communication is concerned, which may involve processing some language in a musical way.

2.4.2 How musicality develops

2.4.2.1 Ockelford (2000) published a paper entitled ‘Music in the Education of Children with Severe or Profound and Multiple Learning Difficulties: Issues in Current UK Provision, a New Conceptual Framework and Proposals for Research.’ In this paper, he proposed a two-strand model of musical development. The first strand focused

upon ‘Music in its own right,’ and a second strand involved ‘Music as a means to inform wider learning and development.’

2.4.2.2 The first strand of the model, ‘Music in its own right’, evolved into a research project called ‘Sounds of Intent’(SoI) which Ockelford set up with colleagues Graham Welch and Evangelos Himonides from the Institute of Education, University of London, and Sally Zimmermann, from the Royal National Institute of Blind People (RNIB). The main goal of the project was to map how musicality develops in children with a range of special needs, including autism. The evidence for the SoI developmental model came from three principal sources:

- 1) Music development literature pertaining to neurotypical children
- 2) Zygonic theory – how music makes sense through pattern
- 3) Observations – many 100s of observations including musical engagement involving children with ASC

2.4.2.3 Sounds of Intent ‘focuses only on the development of musical interests, abilities and preferences, thus avoiding some of the pitfalls to which other current models have been susceptible, in which musical and non-musical elements are conflated’ (Ockelford 2008: p.111). The Sounds of Intent framework categorises musical engagement by setting out a framework of six stages across three domains of engagement:

Reactivity: Listening and responding to sound and music

Proactivity: Causing, creating and controlling sound and music

Interactivity: Listening to sound and music, and making them in the presence of others

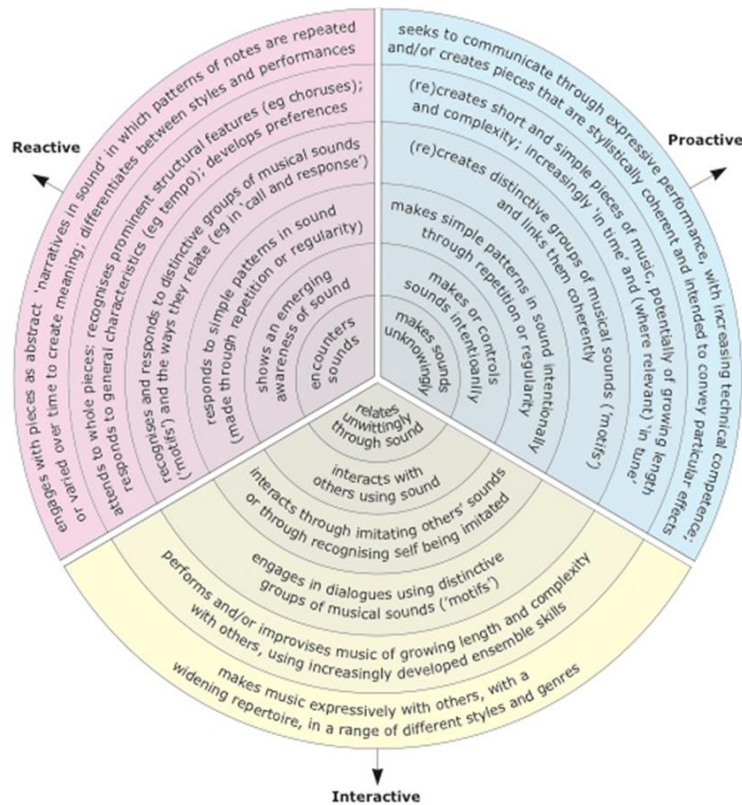


Figure 3.1 The Sounds of Intent framework

2.4.2.4 In the SoI model, these categories are represented as three segments of a circle and expressed over six levels (see Figure 2:1). There are a total of 18 descriptors incorporated within the SoI framework, taking into account the six different levels across the three domains of musical engagement (reactive, interactive, proactive), and each of these 18 descriptors can be broken down into four more detailed elements.

‘Some relate purely to engagement with sound and music, others to sound and music in relation to other sensory input, and the remainder to technical matters

pertaining to performance which it felt became important at levels 5 and 6.’
(Ockelford 2013: p.132).

2.4.2.5 The ways in which elements and levels interact with each other vary. Level descriptors *within* domains are hierarchical, in that ‘achievement at a higher level is dependent on the accomplishment of all those that precede.’ (Ockelford 2013: p.137) There is also contingency *between* domains; thus, the model does not so much indicate particular points on a scale a child might be on but, more realistically, describes a music-developmental profile taking into account different levels of attainment both within and between the three differing domains, which in turn relate to a number of different elements.

2.4.2.6 Boundaries between different stages are in reality not as clear-cut as they initially seem, and there is a danger that, once in print, a model such as the SoI ‘constitutes only a preliminary attempt to portray children’s development, and as such, rather than being the servant of future observations it comes to constrain it’ (Ockelford 2013: p.82). Responses could be ‘forced’ into categories simply because the model is there; as such, reactions to music could become unwittingly misinterpreted. Furthermore, *within* these two strands, comments could quite easily fall into one or more categories. For example, as Ockelford states, ‘It is important to recognise that, like all models of this type, the framework is a gross conceptual simplification of a highly complex area of human activity’ (2008: p.82).

2.4.2.7 The second strand of Ockelford's (2000) model was concerned with how involvement in music might promote wider learning and development. Categories devised for strand two of the model, focusing on ways in which music can promote wider learning and development, are as follows:

Music and Learning

Music and Socialisation

Music and Communication

Music and Movement

It is essential to understand that these categories are not conceptually 'clean.'

2.4.2.7 Conclusion

In this section we have discussed how music makes sense and how music develops with regard to music in its own right and music to inform wider learning and development. In the next section we turn to music language and communication to further explore current thinking on how music might enhance language use and language learning for some children with ASC.

2.5 Music, Language and Communication

2.5.1 The impact of music on cognitive processes

2.5.1.1 Rauscher and Shaw (1994) conducted a study to investigate whether listening to Mozart improved performance in a visio-spatial task performed by undergraduates. The study found that performance in the visio-spatial task significantly improved,

and the researchers believed that the reason for this was ‘Neuronal Cross Modal Priming.’ In other words, listening to Mozart activated the same area of the human cortex involved in visio-spatial skills.

2.5.1.2 Numerous subsequent papers have either accepted, rejected or built upon the views of Rauscher and Shaw. Research carried out by Sarnthein (1997) measured electroencephalogram (EEG) correlations during both music listening and testing in the paper cutting and folding task. The results showed that regions activated while listening to Mozart, namely the right frontal and left temporo-parietal cortices, are also activated during the paper cutting and folding tasks. As such, this would appear to support the ‘cross modal priming between unrelated domains’ hypothesis proposed by Rauscher and Shaw in their 1993 study. Several other replication studies confirmed the existence of the Mozart effect (Rideout and Laubach 1996; Wilson and Brown, 1997). In the Wilson and Brown study (1997), the experimenters used mazes as a test of spatial-temporal cognitive ability rather than the paper folding and cutting task. Results showed that subjects not only completed mazes faster following exposure to Mozart but also committed fewer errors.

2.5.1.3 Studies by Kenealy and Monsef (1994), however, were unable to produce a ‘Mozart effect’ on performance using portions of the Stanford-Binet test, the paper folding and cutting task and the matrices task. Newman and Rosenbach (1995) and Stough and Kerkin (1995) were also unable to obtain a ‘Mozart effect’ when items from the Ravens Progressive Matrices involving multiple-choice tests of abstract reasoning served as the dependent measure. Carsten, Huskins & Hounshell (1995) were unable to produce a ‘Mozart effect’ when the dependent measure was the revised Minnesota

Paper Form Board Test, in which participants have to transform, manipulate, and analyse dimensional objects, and studies by Newman & Rosenbach (1995) were unable to obtain a Mozart effect when items from the Raven's Progressive Matrices served as the dependent measure.

2.5.1.4 Overy (1998) published a paper entitled 'Can Music Really "Improve" the Mind?'

In this paper she wrote:

'It is, of course, well established that musical comprehension is not simply a perceptual phenomenon, but is dependent on a multitude of psychological and cognitive process.' (Overy 1998: p.98)

She asked whether such cognitive processes are developed through interaction with music, and if so, whether they might be transferable to other areas of learning.

2.5.1.5 The paper attracted a number of responses with regard to the role music may play in enhancing cognition. Rauscher (1998) brought to the fore research suggesting that musical training affects brain development. She cited research from Schlaug, Janke, Huang and Steinmetz (1994), who claimed that musicians who started playing instruments before the age of seven had thicker corpora collosa than non-musicians.

2.5.1.6 Spychiger (1998) believed that an important implication of the paper was *how* any gains in cognition (brought about through exposure to music) could effectively be incorporated within the context of the mainstream curriculum. She stressed the importance of high-quality teaching and teacher training to maximise music's potential enhancing effect on cognition.

2.5.1.7 Lamont (1998: p.203) believed that, with regard to exposure to music, ‘children’s cognitive development in areas other than music may be stimulated.’ However, she states that such development may also be influenced by other external factors such as the following:

‘Individual motivation, personality type, parental support, socio-economic status, peer group values, teacher perception, individual instruction, increased concentration developed through regular instruction and practise, practical mastery of a musical instrument, learning notation, enhances self- esteem through participation in a music programme, positive feed-back success, the kind of music instruction and simple exposure to music.’

2.5.1.8 Waters, an experimental psychologist, emphasised the difficulties involved in research carried out to assess the impact of music on cognition, writing that

‘It will be an arduous task to collect detailed data on the acute effects of music perception and production on mental function. Collecting and interpreting data on the chronic effects of music exposure is even more difficult.’ (1998: p.206)

He believed it is important to differentiate between the acute effects (i.e. one dose of musical exposure) and the chronic effects of music exposure (multiple doses over months or years), stating how acute effects are far easier to measure.

2.5.1.9 Gruhn, working at the Musikhochschule in Freiburg, Germany, spoke of spectacular results indicating how music can affect humans’ intellectual capacities but questioned the generalisability of such results, stating,

‘Do we really believe that those effects only come from music making? Do intensive studies of drama or painting, sports or crafts, not cause positive effects?’ (1998: p.208)

In sum, responses to Overy’s question, ‘Can music improve the mind’, focus upon both intrinsic factors within music itself and extra-musical factors in attempting to ascertain the validity of this statement.

2.5.1.10 In a series of subsequent studies (Nantais and Schellenberg 1999; Thompson, Schellenberg and Husain 2001; Schellenberg and Hallam 2005; Schellenberg, Nakata, Hunter and Tamato 2007), Schellenberg conceived of the ‘Arousal and Mood Hypothesis.’ His theory proposed that music modifies the listener’s emotional state, which in turn alters their cognitive performance. Arousal theory proposes that music impacts directly on the autonomous nervous system. Evidence for this came from a particular study (Thompson, Schellenberg and Husain 2001), in which a participant’s performance in visio-spatial tasks also improved after they had listened to a narration of a Steven King novel. Another study (Schellenberg and Hallam 2005) provided evidence to suggest that listening to the rock band ‘Blur’ improved children’s spatial ability more effectively than listening either to Mozart or to a science discussion on Radio 5. In a further study in 2007, Schellenberg provided evidence to suggest that Japanese school children’s drawing improved after they had listened to familiar Japanese children’s songs, but not after they had listened to Mozart. The children who had been exposed to the Japanese folk songs drew for longer periods of time; furthermore, their drawings were judged to be more creative and energetic.

2.5.1.11 Schellenberg concluded from these studies that

‘The arousal and mood hypothesis provides a testable hypothesis that does not rely on music or spatial abilities to explain the effects of music listening on cognition, and both underlying mechanisms (i.e. the music’s effect on the listener’s emotional state; the effect of music on cognition) are well established in the literature’ (2011: p.124).

Thus, for Schellenberg the impact music may have on cognition is not limited only to visio-spatial ability in terms of the independent variable. Furthermore, aspects of cognition that might be enhanced are not exclusively dependent on music. He is not denying that music *can* augment various aspects of cognition but, rather, is suggesting that the enhancement occurs through a process or arousal of the autonomous nervous system, which may also occur under other non-musical conditions.

2.5.1.12 In my study, the central hypothesis is that ‘the co-existence of music and words may facilitate language learning and utilisation for children with Autism Spectrum Condition.’ Although, in the practical phase of this research, the focus is upon the effect of music on verbal recall (and conversely the effect of language on melodic recall), if the music were to have any enhancing effect on verbal recall, then, according to Schellenberg, such an effect could be explained by the presence of music having a direct impact on the autonomous nervous system. For, as Schellenberg states,

‘In sum, music listening (or singing) can lead to enhanced performance on a variety of tests of cognitive ability. These effects are mediated by arousal and mood and are unlikely to differ from those that arise as a consequence of exposure to non-musical stimuli that have similar emotional impact, e.g., giving participants a cup of coffee or a small bag of candy’ (Schellenberg: 2005: p.319).

2.5.1.13 Conclusion

In this section we have discussed research on whether exposure to music can promote wider learning and development. Rasucher and Shaw (1994) believed that exposure to Mozart could enhance visio-spatial skills and that this was due to ‘cross-modal neural priming’. However, research carried out to investigate such claims suggests that the effect could be due to a process of ‘arousal’ due to exposure to music. As such, this effect does not exclusively pertain to Mozart (as other genres of music appeared to have the same effect) or, indeed, music of any type. Having briefly discussed research focusing on the effects of music on cognition for neurotypical individuals, we now turn more specifically to musical interventions carried out with a focus on the effects of exposure to music for individuals with ASC.

2.5.2 Overview of musical interventions for individuals with ASC

2.5.2.1 In this section, we will review research carried out over recent years on the efficacy of musical interventions for children with ASC on social and communication skills.

Following the original papers by Kanner (1943) and Asperger (1944) in 1953, Sherwin undertook investigations involving three young children with ASC.

Findings from his research suggested the following:

‘Investigations on 3 autistic children indicate that musical reactions are intimately bound with psychopathology; that reactions consist of a preoccupation and unusual absorption in music, a rote memory for melodies, a preference for singing over speech, a use of singing occasionally as a communicative means but more generally as an expression of an emotional state, and a response to music heard with rhythmical motions and easing of anxiety.’ (p.823)

2.5.2.2 Sherwin believed that an analysis of the way in which children with ASC react to music could ‘provide further clues’ to the overall psychopathology of the condition, as well as providing leads for the practical applications of music therapy. He concluded that, although his findings provide evidence to suggest that music could be useful as a therapeutic tool for children with ASC, ‘any statement as to its efficacy would be premature’ (p.831).

2.5.2.3 Throughout the 1960s and 1970s, Nordoff and Robbins carried out research using improvisation with children who had been diagnosed with autism. They developed a technique entitled ‘Creative Music Therapy,’ which focused on using musical improvisations as a non-verbal means of communication between the child and the therapist. They improvised music to reflect the motor, vocal, and instrumental behaviours and responses of participants. In one single-subject study involving a six-year-old girl with ASC, they provided evidence to suggest that the intervention enabled the girl to ‘demonstrate progress in increased vocabulary, self-expression,

and the spontaneous use of pronouns' (1968: p.192). In a further single-subject study involving a five-year-old boy with ASC, they again showed how, through the application of music improvisational therapy, significant progress was made by the boy in terms of 'increased vocabulary, development of spontaneous and communicative speech, development of conversational jargon, and acceptance of change in novel situations' (1977: p.118).

2.5.2.4 Edgerton (1994) carried out a study to determine the efficacy of improvisational music therapy based on the Nordoff and Robbins approach. She investigated the effects of music therapy on the communication skills of 11 children with autism, all of whom presented with significant communication impairment. The children, aged between six and nine years, took part in individual various improvised music therapy sessions over the course of 10 weeks. Results of the study suggested that improvisational music therapy was effective in both eliciting and increasing communicative behaviours in autistic children within a musical setting, thus supporting the previous case-studies advocating the beneficial effects of creative music therapy for children with autism. Edgerton believed nonetheless that this study took the results one step further in that, for this enquiry, objective methods of control, observation, and data reporting were applied.

2.5.2.5 With regard to why involvement in improvisational music therapy may enhance communicative behaviour, Edgerton discusses how, in particular, activities involving responding to a change in musical tempo may impact positively on communication. With regard to some of the participants successfully managing to synchronise the tempo of a drumbeat to on-going music, she states that, 'Because of

the fundamentally rhythmic behaviours of autistic children, tempo may initially be one communicative modality in which autistic children can immediately experience success' (1994: p.55). Thus, within music the natural synchrony of repetitive behaviour is mimicked to some degree; as such, according to Edgerton, involvement in music may have enhanced communication for some children with ASC because musical activities in the intervention were synchronised with the children's repetitive movements and vocalisations: 'this could have created a sense of awareness, sense of control over their environment, and a new means of communication' (1994: p.56).

2.5.2.6 With regard to the correlation between the musical vocal behaviour and non-musical speech, Edgerton only speculates that

'it has been stated that communication through music bypasses the speech and language barriers of autistic people; this could be one possible explanation for the observed increases in musical vocal behaviours. However, the significant relationship found between increases in musical vocal skills and increases in speech production skills leads to the question as to whether there is a cause and effect relationship. Further research is needed to examine this question' (1994: p.57).

2.5.2.7 Wimpory and Nash (1999) employed a single case-study to ascertain the impact of music therapy on a three-and-a-half-year-old girl named Heather, who was on the autism spectrum. Heather was regularly filmed (for up to thirty minutes) with her mother during play, with and without toys, throughout a four-month baseline, and then for seven months, following the introduction of twice-weekly musical interaction therapy sessions at home. Five months of unmonitored musical interaction followed. Further filming included footage at the start of the therapy at a

local children's centre, and also at the same centre twenty months after the therapy was withdrawn.

2.5.2.8 Recordings showed that, before therapy, at least six minutes would elapse before Heather acknowledged her mother's presence, if she did so at all. Following the start of the therapy Heather always gave a social acknowledgement, and this usually occurred within a minute. However, throughout the follow-up sessions, this acknowledgement occurred within just nine seconds. Before therapy, eye contact was low, but it averaged twice a minute once therapy had begun, and increased up to six times a minute during the follow-up session. In terms of 'initiation' of interactive involvement, Heather initiated 20% of interaction before therapy, and this increased to 75% during the evaluation. These measures were based on short bursts of interaction, atypical of children with autism, but in the follow-up session instances of playful interaction were more sustained, rendering this measure no longer necessary.

2.5.2.9 Buday (1995) found that children with autism were more responsive to instruction when it was accompanied by music than when it was not. She discovered that subjects imitated signs and speech more accurately when these types of communication were paired with pitched music than when they were linked to rhythms. Within the context of a story in verse, she measured the number of signs and spoken words correctly imitated by children with ASC. Signs and spoken words were paired with singing in one condition and, in the other, signs and spoken words were paired with rhythmic speech without music. The results revealed that the average number of signs and spoken words imitated correctly during the music

condition was significantly higher than the number of signs and spoken words imitated during the rhythm condition. Furthermore, throughout the music conditions, the researcher noticed that fewer stereotypical autistic traits such as hand flapping, head movement and incomprehensible babbling were observed. Buday believed that the presence of music reduced boredom for the children with ASC, and that the positive effect supports the use of music as an augmentative form of didactic language intervention (1995: p.200). The findings produced by Buday would thus seem to suggest that music is a motivating factor for children with ASC.

According to Lim (2012: p.75) however,

‘She did not include several critical elements of speech and language development such as pragmatics, semantics, prosody, or phonology in her measurement. In order to understand the positive effect of music on speech and language skills in children with ASD, it is necessary to examine changes in the children’s communicative behaviours including the use of language after engaging in musical experiences’.

2.5.2.10 Lim (2009) carried out a study to compare the effect of speech training and music training on verbal production of pre-schoolers with ASC. Six songs were composed for the study, which included thirty-six target words or two-word phrases. One group of children were assigned to a music training condition. In the music training condition, a female music student sang songs and showed pictures of the target words/phrases. A second group of children were assigned to a speech training condition, whereby the same pictures of the target words/phrases were employed, although lyrics from the song were recited as opposed to sung. The third group of

children were assigned to a 'no training' condition. In terms of the dependent measure, speech production was assessed in relation to semantics, phonology, pragmatics and prosody using a Verbal Production Evaluation Scale specifically designed for the study by the researcher.

2.5.2.11 Results showed that participants in both music and speech training condition improved scores on the VPES, comparing results before and after the intervention. When participants were classified into 'high- functioning' and 'low-functioning groups,' 'high-functioning' participants improved their scores on the VPES from either the music or speech condition, whereas 'low-functioning' children showed greater improvement after music training. Lim concluded that her study had provided evidence to suggest that, 'Structurally and functionally organised music experiences may enhance speech production and vocabulary acquisition in children with ASC', (2009: p.15) and that, furthermore, 'Music is an effective tool for improving acquisition of functional vocabulary words and speech production for children with ASC. (2009: p.15). One possible explanation offered by Lim as to why exposure to music might impact positively on speech and language and be more effective than speech training alone was the fact that 'Music provides more predictable temporal patterns than speech does, making it easier to be perceived by children with ASC ' (2012: p.14). Thus, according to Lim, pattern organisation within music can facilitate the perception of words and phrases, 'embedded in simple and repetitive combinations of musical patterns that are symmetrical and parallel in form organised with the Gestalt laws of perception' (2009: p.14).

2.5.2.12 Whipple (2013) carried out a meta-analysis of studies carried out to ascertain the effects of music on language and communication for children with ASC, incorporating strict inclusion criteria:

- studies that employed group or individual subject experimental treatment design,
- design, procedures, and results allowed replicated data analysis,
- participants involved were below the age of five years and diagnosed with ASC,
- employment of music as a separate independent variable contrasted with a 'no-music' control condition,
- all music treatment procedures conducted by a music therapist,
- quantitative results reported with sufficient information to extract an effect size.

Studies were in the form of articles published worldwide in peer-reviewed journals (dissertations, theses, and research posters session presentations were excluded).

In total, eight studies were included in the meta-analysis. Three studies focused specifically on communication as the dependent variable: Kern, Wolery and Aldridge (2007), Lim (2010), and Lim and Draper (2011).

2.5.2.13 Variables were converted to an estimated effect size, Cohens d , using meta-analytical statistical software. Within the meta-analysis, music therapy treatment was compared in some studies to no-contact control or standard care conditions. In other studies music therapy treatment was compared to play or speech therapy. A Pearson Product Moment Correlation was used to assess the correlation among Cohen's d . The results revealed that effect sizes ranged from .00 to 5.98, with an overall effect size of $d=0.79$ ($p<0.001$); thus, the results were considered to be significant.

2.5.2.14 Whipple (p.71) concluded that,

‘The further away from 0 the effect size is, the larger the effect. Within the behavioural sciences, an effect size of .20 is considered to be a small effect, while .50 meets the benchmark for a medium effect, and an effect size of .80 or larger constitutes a large effect. Based on these criteria, the overall effect size revealed within this meta-analysis can be considered to be medium-large, indicating that music therapy is an effective treatment for improving communication, interpersonal play and personal responsibility skills of young children with ASD.’

2.5.2.15 Conclusion

The studies I have mentioned in this section suggest that music may have a positive impact on language, although it is not clear why. As Schellenberg suggests, the presence of melody may have an arousing effect, and mere exposure to music may have some kind of stimulating effect on the autonomous nervous system. Conversely, as discussed in the section on music processing and musical development, as Ockelford says, it may be that music is easier to understand for the autistic mind because it is self-referencing (and thus doesn't rely on symbolic understanding) and very repetitive, and that the melody acts 'rather like a clothesline: the notes are pegs, and the words clip on to these in the mind' (Ockelford 2013: p.88). Music may help language if the two are presented together because the music is easier to recall and, subsequently, language might be remembered through a process of association. On the other hand, music and language may share some of the same neural resources. In the next section, evidence from neuroscience suggesting that an overlap between music and language processing exists is examined to ascertain the extent to which the

effects of exposure to music might positively impact upon the neural encoding of speech and language.

2.5.3 Evidence from neuroscience on the impact of music on language

2.5.3.1 Recent evidence from neuroscience suggests that music and language in part share neural networks; thus, exposure to, or involvement in, musical activities impacts upon speech due to enhanced connectivity in the neuronal networks that process language. There have been a number of studies carried out in recent years suggesting that ‘musical training benefits the neural encoding of speech’ (Patel 2011: p.1). Such studies are worthy of mention as they relate to the central hypothesis of my research in that they provide evidence of how the co-existence of music and words may facilitate language learning and utilisation for children with ASC.

2.5.3.2 Strait, Hornickel, J and Kraus (2011) carried out research in an attempt to ‘define relationships between subcortical processing of speech regularities, musical aptitude, and reading abilities in children with and without reading impairment’ (2011: p.44). The researchers hypothesised that, in combination with auditory cognitive abilities, neural sensitivity to speech regularities provides a common biological mechanism underlying the development of both reading and music abilities.

2.5.3.3 Forty-two school-age children were selected for the study and were assessed for their ability in auditory working memory and attention, music aptitude, reading ability, and neural sensitivity to speech regularities. Neural sensitivity to speech regularities was assessed by recording brain stem responses to the same speech sound within both predictable and variable contexts. Correlation analyses and

structural equation modelling suggested that music aptitude and literacy both relate to the extent of subcortical adaption to speech regularities as well as to auditory working memory and attention.

2.5.3.4 The researchers deduced from this that

‘common brain mechanisms underlying reading and musical abilities relate to how the nervous system enhances regularities in auditory input. Definition of common biological underpinnings for music and reading supports the usefulness of music for promoting child literacy, with the potential to improve reading remediation’ (2011: p.44).

This is important in the context of my research since, if there are common brain mechanisms underlying reading and musical abilities, such common brain mechanisms may also have the potential for speech remediation and for assisting recall of the spoken word.

2.5.3.5 In a similar study, Kraus and Chandrasekaran (2010) provided evidence to suggest that musically trained individuals demonstrated superior neural encoding of spoken syllables in the auditory brainstem, through a process of experience-dependent neural plasticity. In opposition to the view that auditory processing is strictly hierarchical, based upon inflexible hard-wired subcortical circuits conveying neural signals, they proposed an alternative explanation that they called the ‘reverse hierarchy theory.’ This theory proposed that auditory processing involved ‘rich two-way actions between sub-cortical and cortical regions, with structured malleability at both levels’ (2010: p.603). In practical terms their proposal suggests that the neural encoding of speech can be enhanced by non-linguistic auditory training, which might include musical training. They believed that, through a process of increased

adaptive plasticity, such musical training might strengthen the same neural processes that are impaired in individuals with certain speech and language processing problems. Implicit in such a belief is the fact that such an increase of adaptive plasticity cannot be achieved through exposure to language alone. In terms of *why* musical training may influence adaptive plasticity in speech processing, Kraus and Chandrasekaran believe that the effect comes about because both music and speech use pitch timing and timbre to convey a message, suggesting that, over a period of time, ‘years of processing these cues in a fine-grained way in music may enhance their processing in the context of speech.’ (2010: p.603)

2.5.3.6 This study is important here, as it provides evidence to suggest that the co-existence of music and words may facilitate language learning and utilisation for children with ASC, as the increased plasticity between cortical and subcortical regions of the brain as a result of exposure to music cannot be achieved through words alone. It is important, however, to recognise the researchers’ statement that ‘years of processing these cues in a fine-grained way in music may enhance their processing in the context of speech.’

2.5.3.7 In a paper entitled ‘Why would musical training benefit the neural encoding of speech? The OPERA hypothesis’, Patel (2011) builds on the idea that the co-existence of music and words may facilitate language learning and goes into further detail in terms of *why* the process works. The OPERA hypothesis proposes that five essential conditions have to be met before music-driven adaptive plasticity in speech processing networks occurs.

2.5.3.8 These conditions are as follows.

1) Overlap

For the encoding of speech to be influenced by musical training, an acoustic feature for both speech and music perception must be processed by overlapping brain networks.

2) Precision

Music perception places higher demand on the nervous system than speech, in terms of the more complex precision of neural encoding required for adequate communication to occur.

3) Emotion

For musical training to enhance the neural encoding of speech, musical activities sharing the same speech processing networks must elicit strong positive emotion.

4) Repetition

Musical activities engaging these networks are frequently repeated.

5) Attention

Musical activities that engage these networks are associated with focused attention.

2.5.3.9 Patel concluded that the OPERA hypothesis contributes to the growing body of research aimed at understanding the subtle and complex relationship between musical and linguistic processing in the human brain, stating that understanding this

relationship would have implications for how a variety of language disorders might be studied and consequently treated.

2.5.3.10 It is important to note that the researchers state that, for music-driven adaptive plasticity in speech processing to occur, all five conditions within the OPERA hypothesis must be met, and this may explain why some individuals with limited linguistic abilities can still be highly musically skilled. For, if all five conditions are not met, for such individuals, music-driven adaptive plasticity in speech processing may not exist.

2.5.3.11 This theory is relevant to my research because it provides an explanation of why musical training may enhance the neural encoding of speech. However, it must be stated that this paper discusses musical training, as opposed to the effects of the presence of music. The central hypothesis in my research focuses on ‘the co-existence of music and words,’ as opposed to the long-term effects of musical training. Nevertheless, this study is still of relevance in that it proposes a series of conditions that, if met, may explain why exposure to music may augment linguistic ability for children with ASC.

2.5.3.12 Wan and Schlaug (2010: p.797) state that ‘the language deficits in autism may be due to structural and functional abnormalities in certain language regions (e.g., frontal and temporal), or due to altered connectivity between these brain regions.’ In particular, they believe that a number of anatomical pathways that connect auditory and motor brain regions (e.g., the arcuate fasciculus, the uncinate fasciculus and the extreme capsule) may be altered in individuals with autism. They propose that

music-based interventions (involving music making and intensive musical training over long periods of time) might take advantage of the potential musical strengths of children with ASC, and that such interventions would be likely to engage, and possibly strengthen, the connections between frontal and temporal regions bilaterally.

2.5.3.13 They go on to describe a particular type of music training, known as Auditory-Motor Mapping Training (AMMT). They believe that AMMT has the potential to engage and strengthen the connections between frontal and temporal regions that are abnormal in autism because it facilitates auditory-motor mapping and engages a bilateral network that overlaps with components of the mirror neuron system (MNS) – the system containing neurons that respond to the actions of the self and others. AMMT involves three main components: singing, motor activity and imitation.

1) Singing

Singing (more than speaking) is known to engage a bilateral reciprocal network between frontal and temporal regions, which contain some components of the putative mirror neuron system.

2) Motor activity

Motor activity (through playing an instrument) not only captures the child's interest, but also engages a sensorimotor network that controls orofacial and articulatory movements in speech. The sound produced by the instrument may also facilitate the auditory-motor mapping that is critical for meaningful vocal communication.

3) Imitation

Imitation through repetitive training facilitates learning and alters the responses in the MNS.

2.5.3.14 The potential utility of AMMT to amend the language deficits in autism is reinforced by neuro-imaging research showing overlapping responses to music and language stimuli (and in this respect fulfils the first prerequisite of the OPERA hypothesis proposed by Patel). Research has also shown (Tettamanti, Moro and Messa et al. 2005; Emanule, Boso and Cassola 2010) that the dopaminergic system (the system within the cortex that is dependent on the neuro-transmitter dopamine, which regulates arousal and emotion) plays an important role in some aspects of language processing (e.g., grammar) and also mediates musical pleasure in individuals with autism. Furthermore, a common network appears to support the sensorimotor components for both speaking and singing, and engaging in musical activities has been shown to improve verbal abilities in language-delayed children.

2.5.3.15 Lai (2012) carried out a study suggesting that, despite language disabilities in autism, music abilities are frequently preserved. In accordance with the views of Patel, the study provided data to suggest that brain regions associated with these functions typically overlap, enabling investigation of neural organisation supporting speech and song in autism. Neural systems sensitive to speech and song were compared in low-functioning autistic and age-matched control children.

2.3.5.16 The results provided evidence to suggest that activation in left inferior frontal gyrus was reduced in autistic children relative to controls during speech stimulation, but

was greater than controls during song stimulation. Functional connectivity for song relative to speech was also increased between left inferior frontal gyrus and superior temporal gyrus in autism, and large-scale connectivity showed increased frontal–posterior connections. Lai concluded that

‘Together, these findings indicate that, in autism, functional systems that process speech and song were more effectively engaged for song than for speech and projections of structural pathways associated with these functions were not distinguishable from controls’ (2012: p.973).

2.5.3.17 Conclusion

In this section we have looked at evidence from neuroscience on the impact of music on language, for both neurotypical children and children with ASC. Research and theorising suggest that exposure to music may enhance neuronal connectivity and plasticity in regions responsible for language; therefore, such findings support the central hypothesis in this research, that the co-existence of music and words may facilitate language learning and utilisation for children with ASC.

2.5.4 **Encoding of song in memory**

2.5.4.1 Having viewed evidence from neuroscience on how the presence of music may impact upon the neural encoding of language, in this section we turn to research over the last thirty or so years into how songs are stored in the memory. The main focus of such research has been to determine whether lyrics and melody are stored independently or whether the process is somehow integrated.

2.5.4.2 Serafine, Crowder and Repp (1984) carried out a study to examine whether the memory representation for songs consists of independent or integrated components

(melody and text). According to Serafine (1984: p.286), interest in this issue arose through informal observation, causing one researcher to believe that lyrics and melody were integrated in memory. She gave an example of how a two-year-old girl she had observed could remember a number of simple songs but could not sing the songs on the syllable 'La'; furthermore, the infant found it difficult to repeat just the words alone. This anecdotal evidence suggested that the process of storing lyrics and melody is integrated, and that lyrics and melody are not processed independently.

2.5.4.3 A further example to support the integration process was the fact that when people were asked to say their 'National Anthem', they would invariably have to sing under their breath to remember the words. With regard to my research, if children in either the ASC group or the comparison group differed in their ability to recall words alone or melody alone, this may suggest that the words and music are stored independently.

However, if there was no difference, or if the presence of music could enhance verbal recall and, conversely, the presence of language could enhance melodic recall, this may suggest that words and melody are integrated in memory.

2.5.4.4 Serafine, Crowder and Repp (*op. cit.* p.287) asked their participants to listen to a serial presentation of excerpts from largely unfamiliar folksongs, followed by a recognition test. The test required the participants to recognise songs, melodies, or texts and consisted of five types of items:

- Exact songs heard in the presentation
- New songs
- Old tunes with new words

- New tunes with old words
- Old tunes with old words of a different song from the same presentation ('mismatch songs').

2.5.4.5 The main hypothesis was that, if melody and text are integrated in memory, old tunes should be recognised more accurately in old songs than in mismatch songs, or songs with new words. In a similar vein, old words should be recognised more accurately in old songs than in mismatch songs or words with a new melody. Results confirmed the main hypothesis, revealing that 'old tunes' were recognised more accurately in old songs than in mismatch songs or songs with new words. The advantage for old songs over mismatch songs was highly significant across subjects and across test items. With regard to 'old words,' words were recognised more accurately in old songs than in mismatch songs with a new tune. The advantage for old songs over mismatch songs fell just short of significant across subjects, although the researchers believed that this was due to a ceiling effect. The researchers concluded that 'these results suggest that the melody and text are integrated in memory to a considerable degree' (1984: p.294).

2.5.4.6 In a second experiment, a similar procedure was carried out, although this time with the addition of a female voice in the alto range alongside the male voice heard in experiment one. A second difference was that 50% of participants were instructed to listen to the melody only and not to listen to the words, as they would be tested later for melodic recall. Results again confirmed the integration effect. Participants recognised tunes more accurately in old songs than in mismatch songs across participants and across items. Once again, there was also a highly significant main

effect for words, with participants giving significantly more responses when words were old than when words were new, across subjects and across items. The researchers concluded that

‘the integration effect is robust. Melody and text appear to be integrated in memory, even in the face of attempts to focus on or separate the melody at the presentation stage, and even when the performer is different at the recognition stage’(1984: p.298).

2.5.4.7 A similar investigation to the study conducted by Serafine, Crowder and Repp was carried out by Morrongiello and Roes (1990). Morrongiello and Roes were interested in how young children encode song in memory, and how any developmental changes in the processing of words and music in memory might occur. In their study, there were two groups of participants, comprising one group of preschool children and an adult control group. In the familiarisation phase, the preschool children and the adult control group took part in two test sessions. One session comprised three novel tunes each accompanied by rhyming text. The other session comprised the same three tunes accompanied by non-rhyming text. Following on from the familiarisation phase, participants underwent a recognition test, consisting of either

- The original song
- A completely new song (new words, new tune)
- A mismatch song
- Old words with a new tune
- New words with an old tune

2.5.4.8 Participants had to decide whether songs were, ‘exactly the same,’ ‘somewhat the same,’ or ‘not at all the same’ as the original songs. Results revealed that, for the ‘new song’ condition, both children and adults recognised the novelty of the song, and that there were no age differences between ‘not at all the same’ responses which approached the ceiling at each age. Furthermore, both adults and children performed at comparably low levels in judging the new songs as ‘exactly the same,’ and ‘somewhat the same’.

2.5.4.9 In contrast, for the ‘old words/new tune’ condition children made significantly more ‘exactly the same’ responses than the adults, and adults made significantly more ‘somewhat the same’ responses than children. In a similar vein, for the ‘new words/old tune’ condition, children rated these as ‘not at all the same’ significantly more than adults, while adults rated these as ‘somewhat the same’ significantly more than the children.

2.5.4.10 In sum, completely different songs were correctly judged as ‘not at all the same’ by children and adults alike. The main difference between adults and children was in terms of songs that retained some of the former components of the original song. For these excerpts, children were more likely to judge songs that retained the words as ‘exactly the same,’ and to judge those that changed the words as ‘not at all the same,’ even when the melody was retained. Adults, on the other hand, recognised all of these as ‘somewhat the same’ as the original songs. The researchers surmised that children showed better memory for the words than the tunes of the songs, whereas adults showed good recognition memory for both song components.

2.5.4.11 The conclusion did not confirm the hypothesis proposed by Serafine et al. (1984), that text and tune would be integrated in memory, and the researchers cite the anecdotal evidence of the two-year-old child who found it difficult to sing songs she knew well on the syllable 'la'. They deduced from this that the integration hypothesis was based on 'performance,' as opposed to 'recognition', whereas in the present study the children were only asked to *recognise* the songs rather than sing them. Furthermore, they believed that children may use one memory strategy for different song recognition and a different strategy for song production, with the degree of integration of text and tune varying accordingly.

2.5.4.12 The researchers concluded that data from the study indicate that, for both adults and, to a significantly lesser degree, preschool children, processing of words and melody is integrated. However, despite the process of integration, listeners, particularly the children, found the words to be more salient than the tune. They stated that future studies should focus not only on recognition of song but also on production of song, as there may be a significant difference in the process involved.

2.5.4.13 In recent years, in attempts to ascertain how words and melody are processed in memory, and the extent to which the process is integrated or independent, a slightly different tack has been taken, with research conducted on participants with brain injuries.

According to Peretz,

'Studies with brain-damaged populations have shown that amusic patients (i.e. patients who have difficulty processing music after brain insult) are able to make familiarity judgements when song texts are presented in a spoken form, whilst they are unable to do so when the tunes are sung on the syllable 'la' (2001: p.179).

2.5.4.14 She surmised that such results illustrate how familiarity judgement for one component of a song may be intact, while for another component it may be disrupted. She believed that such data, ‘suggest some independence between text and music in songs’ (2001: p.179). However, such studies only assessed recognition of song components in isolation, whereas she was interested in studying recognition of song components in a brain-damaged patient when an actual song (incorporating words and music simultaneously) was presented.

2.5.4.15 Peretz carried out a study (2002) in which recognition of text and tune in songs was examined in a music agnostic patient and five matched controls. Participants were instructed to listen to one component of the song at a time (either music or text) and then decide whether the component was familiar or unfamiliar. The songs that were presented were either matched (in that they were complete versions of either a familiar or unfamiliar song) or mismatched (whereby one component was familiar and one component was unfamiliar). Songs from the matched and mismatched sets were similar in length.

2.5.4.16 Peretz predicted that, if text and tune are separable in memory, the recognisability of each component should not be influenced by the presence of the other component. Consequently, performance should be the same for matched or mismatched tunes. If, however, text and tune are *integrated* in memory, performance should be higher for matched as opposed to mismatched songs.

2.5.4.17 The results revealed that, for the matched control, the effect of song type was significant. The effect of instruction was also significant, with better performance

under the text instruction than the tune instruction. The interaction between instructions and song type was also significant. The difference between matched and mismatched songs in the text condition fell just short of significance, although the researchers believed that this was due to the high performance level achieved by the matched controls. However, in the tune condition, this difference for the matched controls was significant.

2.5.4.18 The researchers reasoned that these results indicate that the matched control group found it difficult to separate the text and the tune of a song:

‘Even when a judgement of familiarity must be made on only one component of a song, the other component cannot be ignored and influences the judgement. A component of a song, be it the text or tune, is easier to judge as being familiar or unfamiliar when it is accompanied with its original companion.’ (2002: p.172)

2.5.4.19 In the case of the music agnostic patient, she performed within the normal range for text recognition with an overall mean of .90. The advantage for mismatched over matched songs was not significant, revealing that, in contrast to the control group, she could ignore the tune while making a familiarity judgement on the text of a song. The researchers thus surmised that as the tune (whether familiar or unfamiliar) had little influence on the music agnostic patient’s judgement, this was an indication of ‘a fair level of separability between the text and the tune of a song.’

2.5.4.20 The researchers believed that in this experiment the song lyrics may be represented in both the title and the first line of the song. Thus, in order to test song memory, in a second experiment lyrics from later verses were used over the same melody, ‘hence

allowing variation of the strength of the representation for words while keeping the tune constant' (p.173).

2.5.4.21 For the matched control, the effect of song type was again highly significant. For the music agnostic patient, the effect of song type was not significant. The researchers surmised that these results once more revealed that the text and tune of a song are difficult to separate in neurotypical subjects. Furthermore, as the patient was able to decide whether or not the text was familiar, but had difficulties processing the musical parts of the song, the relationship between text and tune may be one of association as opposed to integration. They reasoned that if text and tune were integrated in memory, familiarity of text for the music agnostic patient should have suffered in the presence of an irrelevant tune; however, this was not the case, 'suggesting that text and tune are related by association links, each tapping on independent processing in resources (p.178).'

2.5.4.22 The researchers concluded that 'Overall the results are interpreted as revealing strong association, not integration, between the musical and the verbal component of familiar songs.'

2.5.4.23 Conclusion

In this section we have discussed research focusing on whether music and words are processed independently, or whether the processing of words and melody is integrated. Findings are somewhat varied as, for some individuals with brain injury, the recall of language may be preserved but recall of melody may be impaired, which may suggest that words and music are processed independently. However, in

some neurotypical individuals, findings from research on how song is encoded in memory would suggest that the process is integrated. Having discussed how song may be encoded in memory, and whether this is an integrated process, or whether words and music are stored independently, we now turn to research focusing on the unique cognitive style of children with ASC in an attempt to further understand why the presence of music may impact on speech and communication for this population.

2.5.5 Local bias in processing of speech and language

2.5.5.1 In this section, in addressing research attempting to ascertain why music may impact upon language for individuals with ASC, we turn to the third theory mentioned in the introduction: the cognitive style attributed to individuals with ASC. Research has suggested that some individuals with ASC have enhanced perceptual processing skills, with a bias towards processing stimuli locally as opposed to globally, and Mottron, Peretz and Ménard believe that this may positively affect the way music is processed and explain why, for some individuals with ASC, the presence of music may enhance speech and language processing. We start with papers providing evidence to suggest that some individuals with ASC have enhanced perceptual processing skills.

2.5.5.2 Mottron, Peretz and Ménard (2000) carried out a study that examined musical information processing in autistic individuals. Thirteen high-functioning individuals took part along with 13 neurotypical individuals matched for age and IQ. Only participants without musical experience or special musical abilities were included in the study. Stimuli comprised 12 melodies. The melodies were all tonal, insofar as they all started and ended on the tonic, and only included diatonic notes. Each

melody consisted of nine separate tones, each lasting 350 msec., and three types of modification were applied to each of the 12 melodies.

2.5.5.3 In the first modification the melody was transposed up either by raising each tone a perfect fifth or lowering each tone by a fourth. The second modification consisted of creating a contour-violated alternative form of each basic melody by changing the pitch of one tone so that it modified the pitch direction of the surrounding intervals. The third modification consisted of a contour-preserved alternate melody.

2.5.5.4 Results showed that, with regard to the first two melodic modifications, there was no deficit in a same-different recognition task between the original melody for the ASC group and that of the control. However, in the third melody modification condition, i.e. the non-transposed contour-preserved melodies, the children with ASC performed better than the control in the detection of change. The researchers believed that,

‘These findings confirm the existence of a ‘local bias’ in music perception in individuals with autism, but challenge the notion that it is accounted for by a deficit in global music processing.’ (2000: p.1057)

2.5.5.5 The participants with ASC still got the ‘gist’ of the tune, and their processing of the relationship between the separated elements within the melody was superior when compared to their neurotypical peers. The relevance of these findings to my study is that, if children with ASC have superior local processing skills compared to their neurotypical peers, how might this impact on the effect of music on language? Some children with ASC may be able to recall the details of these links; thus, if words and

music are presented together, the words will become associated more readily with the intervals within the melody than they might have done had the words been presented on their own.

2.5.5.6 The study mentioned above examined how children with ASC processed music phrases, suggesting that some children with ASC are more likely to process musical events on a local as well as a global level. In a similar way, several studies have been carried out to ascertain how the propensity of children with ASC for local processing may affect the processing of speech.

2.5.5.7 Ockelford (2013: p.214) wrote that,

‘Evidence that some children may attach particular importance to everyday sounds and that, in some cases (presumably as a result), auditory perceptual skills may become heightened in this domain, comes from my studies of young people who are born blind or who lose their sight in the first few months of life.’

He went on to explain that some children with ASC may have a similar fascination for everyday sounds because, ‘a proportion of autistic children have problems in processing visual information’ (2013: p.217). He states that

“one can speculate that this cognitive anomaly is linked to ‘weak central coherence,’ that is to say, the tendency to focus on parts of things as opposed to seeing things as a whole.”

2.5.5.8 Evidence for such ‘bottom-up’ processing was provided by Järvinen-Pasley, Wallace, Ramus, Happé and Heaton (2007). They tested processing biases in children with autism and matched controls using linguistic stimuli with competing low-level perceptual and high-level semantic information.

2.5.5.9 In the first experiment, twenty children with a formal diagnosis of ASC and a control group of twenty neurotypical children matched for age, gender and intellectual ability were exposed to stimuli comprising 16 speech samples and 16 ‘perceptually analogous’ music samples. Contours in pitch were matched by variation in prosody in the linguistic stimuli. Analogous contours in the music stimuli were created using five-tone sequences. The contours in each condition were ascending, descending, low-high-low or high-low-high. The speech stimuli comprised five spoken syllables common in everyday language. Examples included, ‘Tom loves eating chips’ and ‘Reading books is fun’. Within the music stimuli, tones appeared in an eight-semitone range.

2.5.5.10 In the linguistic-perceptual condition, participants were informed that statements would vary in pitch, and the four contour shapes were presented to them on a laptop. They had to identify which type of contour had been used in the sentence they had just heard. In the non-linguistic perceptual condition, participants were asked to identify the contour they had just heard incorporated in the musical phrase.

2.5.5.11 The performance in both groups of children was significantly above chance in both conditions, suggesting that, as similar levels of performance were seen across the linguistic perceptual and non-linguistic perceptual conditions, neither group of children showed evidence of semantic interference upon perceptual processing ability. In other words the presence of words had no detrimental effect on perceptual processing of stimuli for either group.

2.5.5.12 In a second study, the researchers sought to identify perceptual and semantic information processing biases acting upon temporally patterned as opposed to pitch information, i.e. how would processing of linguistic and non-linguistic stimuli be affected when pitch remained constant and different patterns of rhythm were employed? Stimuli were 16 intact speech and 16 perceptually analogous non-speech vocal samples. For example, a speech sample, ‘Let’s go for a walk’ was replicated non-linguistically by a female intonating the vowel A, reciting the sequence, A-A-A-A-A, whereas the sentence ‘Stella often dances’ was replicated using the sequence AA-AA-AA. The two other patterns used were A-AA-A-AA and AAA-AA-AAA.

2.5.5.13 Children with autism performed at a significantly higher level than their matched controls in the linguistic perceptual condition, while control children showed superior sentence comprehension to those with autism. However, unlike in experiment 1, there was no significant between-group difference in performance in the non-linguistic perceptual condition. This was an important finding. Children in the control group did just as well as the children in the ASC group in the condition where there was variety in rhythm, as opposed to the variety in pitch (experiment 1) where, as we have seen, the controls performed less well in the perceptual linguistic condition.

2.5.5.14 Järvinen-Pasley et al. concluded that

‘When the perceptual task was to process pitch contour information, neither controls nor children with autism succumbed to semantic interference. By contrast, when the perceptual task was to detect differences in temporal patterning, control participants exhibited clear semantic capture, achieving significantly

higher levels of perceptual discrimination of semantically meaningless as compared to semantically meaningful stimulus.’ (*op. cit.*, p.8)

2.5.5.15 The researchers concluded that such a finding implies that children with autism have superior perceptual processing of speech when compared to age-matched controls, and that “semantic-level processing is not the primary, or ‘default’, speech processing mode.” (*op. cit.*, p. 9)

2.5.5.16 Conclusion

In this section we have looked at research focusing on how children with ASC might process sound differently from their neurotypical peers. Findings from research confirm the existence of a ‘local bias’ in music perception in individuals with autism, whereby such individuals have an enhanced ability to recall the precise patterns linking elements embedded within melody. Ockelford (2013) contends that, for children with ASC, this cognitive style originates in the first few years of life. In the next section this concept is explored further.

2.5.6 **The Exceptional Early Cognitive Environment**

2.5.6.1 Ockelford (2013: p.41) asserted that ‘Autism creates an Exceptional Early Cognitive Environment’ (EECE), which can be problematic for language acquisition (and consequently language use) in that sounds are more likely to be processed perceptually as opposed to semantically and, as such, all sounds are processed as ‘inherently musical.’

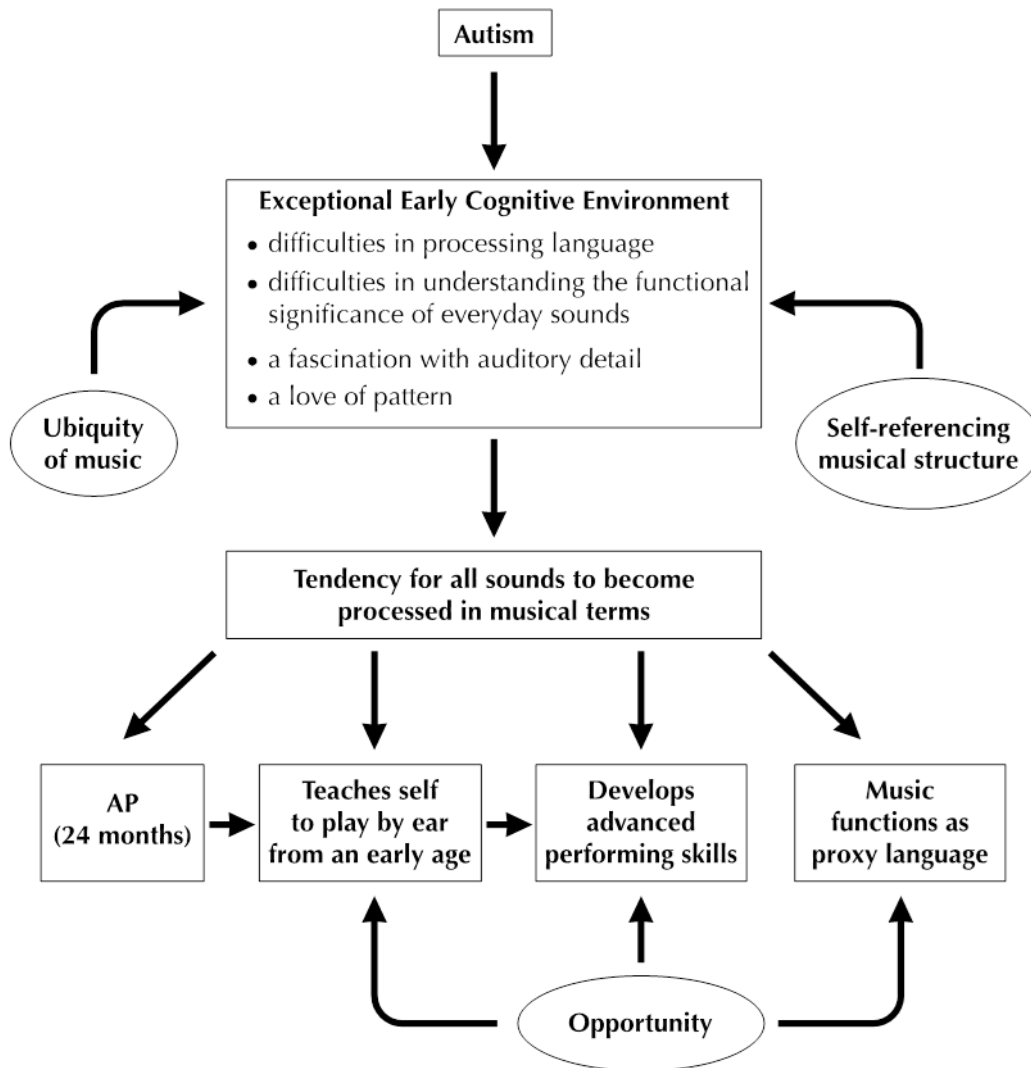


Figure 3.2: The Early Exceptional Cognitive Environment

2.5.6.2 It seems that, for children with learning disabilities and also ASC, the broad musical path with regard to development is the same as for neurotypical children, but it can occur at different rates. The driving force behind exceptional musical development is absolute pitch, and that, Ockelford contends, is what can make a difference. In the next section we turn to research focusing on children with ASC who possess absolute pitch in an attempt to understand how this might affect processing for both speech and language.

2.5.7 The prevalence of absolute pitch in children with ASC

2.5.7.1 Heaton (1998) conducted a study in which musically 'naïve' autistic children were compared with musically 'naïve' mental age-matched control subjects for their ability to identify and remember single-note frequencies or speech sounds. As an analogy to testing for absolute pitch, subjects were asked after two different time intervals to point out animal pictures previously paired with either the notes C4-E4-G4-B4, or the speech sounds, 'la'-'ha'-'da'-'ta.'

2.5.7.2 The results showed that, although both groups identified and recalled speech sounds equally well, those with autism demonstrated a superior ability for single-note identification over both time intervals. This suggested that children with ASC were more likely to possess absolute pitch (AP) – the ability to match a specific musical pitch to an arbitrary verbal or visual label. Heaton alleged that the superior pitch processing skills possessed by children with ASC are a result of a bias toward a local, rather than a global, processing strategy; this is a disadvantage in most contexts, but in some instances it gives these individuals privileged access to aspects of the physical world that are normally overridden by tendencies toward holistic perception.

2.5.7.3 In a second experiment conducted by Heaton and Pring, participants were presented with 48 melodic pitch intervals and were subsequently asked whether the intervals moved up or down. Results revealed that children with ASC could demonstrate equally high levels of performance with small intervals (1 – 4 semitones), medium intervals

(5–8 semitones) and large intervals (9 – 12 semitones). Conversely, a matched control group only achieved a higher level of performance with the medium and large intervals. Again, such results would suggest that ‘autism is characterised by a cognitive style deficit that biases processes towards local features.’ (1998: p.443)

2.5.7.4 According to Ockelford (2013: p.218), ‘children on the autistic spectrum are around 500 times more likely to have highly developed ‘absolute’ perceptual skills than those in the general Western population.’ Furthermore, AP in the general population may be limited to one instrument (i.e. the piano) and may be limited by range, although Ockelford states that, from his own teaching experience, for children with ASC no such restrictions prevail, in that their AP is ‘universal’, which applies to all categories of sound, irrespective of content (2013: p.219). Although such evidence is informal, these observations were made over many years, and the validity of such a claim would merit further research. This implies that, for individuals with ASC, music ‘is likely to be very different from that of the majority: more vivid, more intense, more exciting, more exhausting’ (2013: p.226).

2.5.7.5 Bonnel et al. (2010) conducted a study to test abilities of pitch discrimination among participants with autism and participants with Asperger syndrome. The study suggested that participants with autism, but not those with Asperger syndrome, displayed enhanced pitch discrimination for simple tones. The researchers concluded that ‘persons with autism display a particular strength in discriminating between pure tones that differ in pitch. Together with the evidence of superior processing of visual information in the primary visual cortex, the findings indicate that functions served by primary perceptual areas are enhanced in autism’ (2010: p.2473).

Furthermore, they believed that such a finding implied that ‘enhanced pure-tone discrimination may be a cognitive correlate of speech-delay among persons with ASD’ (2010: p.2465).

2.5.7.6 Conclusion

In this section we have discussed the concept of the Early Exceptional Cognitive Environment, and the prevalence of absolute pitch in children with ASC. The main findings are as follows:

- There is a tendency for all sound to be processed as music.
- This may pose a problem for language use and learning
- There is a high prevalence of absolute pitch in children with ASC
- In terms of musical development, AP can serve as a huge advantage.

2.6 **Conclusion**

2.6.1 This chapter has reviewed literature related to the central hypothesis of this research, that ‘The co-existence of music and words may facilitate language learning and utilisation for children with ASC.’ We have considered what is meant by ASC, how some aspects of memory in ASC may be unique, and the implications this may have for how music impacts upon language for such individuals.

2.6.2 We discussed why some individuals with ASC find language challenging, particular with regard to articulation, word use and syntax. The prevalence of echolalia in ASC was considered with regard to its function and how it can inform us of ways in which individuals with ASC may process speech and language.

2.6.3 We then turned to how music makes sense, how music develops, and how some individuals with ASC may process music in a unique way, before examining research carried out on the effects of music on language from both a neurological and a cognitive perspective. Finally, we discussed the possible existence of an exceptional early cognitive environment for some children with ASC and the implications of this for music and language processing.

2.6.4 In an attempt to ascertain *why* music may facilitate language use and learning, three existing theories emerge from recent research:

- Arousal theory
- Shared Neural Resource theory
- Unique cognitive style of individuals with ASC

2.6.5 Having reviewed the literature and research carried out on issues related to how music may impact upon language, we now return to the central hypotheses and research questions at the core of my research, before discussing and analysing results from the three separate phases that my study comprised. Research carried out on the effects of music on language has suggested that, through one of the three avenues mentioned above (see 2.6.4), the presence of music may augment language learning and language recall for both children with ASC and neurotypical children. To further consider (and potentially validate) this phenomenon, my central hypotheses are as follows:

- The co-existence of music and words may facilitate language and music learning and utilisation for children with ASC.

- This effect will be more marked for children with ASC than for those developing neurotypically.

2.6.6 Additionally, research has cited evidence to suggest that children with ASC and ‘neurotypical’ children may process words and music differently (see 2.5.5.2). To further investigate the differences in the ways that children with ASC and ‘typically developing children’ process music and language, my research questions are as follows:

- Does the co-existence of melody with a string of words make the words easier to learn and reproduce for children with ASC?
- Does the co-existence of melody with a string of words make the words easier to learn and reproduce for ‘typically developing’ children?
- Does the co-existence of melody with a string of words make the music easier to learn and recall for children with ASC?
- Does the co-existence of melody with a string of words make the music easier to learn and recall for ‘typically developing’ children?

Chapter 3: Rationale for the design of the investigation

3.1 Introduction

In this chapter we turn to the rationale behind the design of the investigation as a whole. We set out the sequence of the three studies, before considering the way in which the data will be analysed, and the thinking behind the employment of both qualitative and quantitative methods. Finally the potential impact of the role of the researcher as participant in the research is considered, from both an ethical and procedural point of view.

3.2 Rationale behind the design of the investigation

3.2.1 This research was carried out to better understand the relationship between music and language for children with ASC. As discussed in the introduction (see 1.1.5) my interest in the effects of the impact of speech and language on music for this population arose from anecdotal evidence. At the outset of this research I was not initially clear as to the type of musical activity or the context within which music would occur, and what aspects of language should be focussed upon.

3.2.2 As such, my thinking in terms of processing information was ‘bottom up’, and as the research progressed this would evolve to become more ‘top down’. In other words, I started out looking to collect and generate themes that emerged in relation to the impact of music on speech and language for individuals with ASC, which could later be identified and tested on a larger population. In the early stages of this research I

was looking to generate hypotheses that could subsequently be tested in the later phases of this research.

3.3 Sequence of studies

- 3.3.1 A decision was taken to divide the research into three separate phases. These comprised:

Phase 1 Semi-structured Interviews

Phase 2 Questionnaire

Phase 3 Comparative Intervention

- 3.3.2 Semi-structured interviews were primarily chosen in order to gain some information on how (if at all) parents, teachers or carers may have noticed that exposure to different types of music, or involvement in different types of musical activities, might enhance the children's communication skills, with an emphasis on word production, or non-verbal vocalisation. It was envisaged that the interviews might produce a rich source of data from a relatively small population, which could subsequently be used to inform a questionnaire, to be sent out to a larger population. However, results from the interviews were also used to complement the findings from the questionnaire, and as such it was hoped that the results would be of some value in their own right.

- 3.3.3 With regard to the design of the interviews in this study, in that participants could air their views on issues in their own terms, it was hoped that emergent data would not so much accord with pre-conceived notions the researcher might have, but rather generate new themes and categories to explore. For instance, the extent to which

exposure to music might enhance relationships with other people for children with ASC was not something that was included in the original preliminary interview questions, but nonetheless, was something that participants discussed at length.

- 3.3.4 With regard to the questions to be asked in the interviews, although all of these were formulated in advance, the questions were conceived as ‘points of reference’, whereby issues related to each point could be further explored, which in turn could generate new questions. In this sense the process was iterative, in that issues related to the questions could in turn engender further avenues of exploration.
- 3.3.5 The interviews were semi-structured. This was so as to maximise freedom of participants, who could answer questions put to them in whatever way they wished. According to Cohen and Manion (2011: p.419) one advantage of an open response is that, ‘it does ensure that the respondent has the freedom to give her answer as fully as she chooses rather than being constrained in some way by the nature of the question.’
- 3.3.6 The key findings of the semi-structured interviews were used to inform a questionnaire which could then be sent out to a much larger population. Standard email requests were sent out to hundreds of organisations over the period of three months in anticipation of a low response rate. Respondents were given the option of leaving contact details at the end of the survey, although this was not compulsory, and if they so wished they could fill in the survey anonymously.
- 3.3.7 All initial e-mails to respondents clearly explained that the research was part of a PhD at the University of Roehampton. This in itself could have affected the way

respondents answered questions in that such an explanation may have influenced their perception of the overall nature of this research. In that participants knew that the questionnaire was being carried out in the context of academic research, answers given might have been different if the questionnaire was being carried out for any other reasons.

3.3.8 The questionnaire employed two different types of questions:

- Dichotomous questions
- Multiple choice questions

Advantages and disadvantages of these type of question are discussed in chapter 5 (see 5.2.3)

3.3.8 Phase 3 of the study involved a comparative intervention consisting of one group of 24 children with ASD, and a comparison group of 32 ‘neurotypically’ developing children. It was a repeated measures design. The rationale behind this was that with regard to children with ASC, due to the distinctive and somewhat idiosyncratic traits they might present, it would be difficult to match two similar groups.

3.3.11 Analysis of data was both from a quantitative and qualitative perspective. According to Jones and Bartlett (2011) quantitative research is objective and based on deductive reasoning whereas qualitative research is subjective and based on inductive reasoning. More explicit differences between these two perspectives are shown in table 3.1.

Quantitative Research	Qualitative research
Considered a hard science	Considered a soft science
Objective	Subjective
Deductive reasoning used to synthesise data	Inductive reasoning used to synthesize data
Focus – concise and narrow	Focus – complex and broad
Tests theory	Develops theory
Basis of knowing – cause and effect relationships	Basis of knowing – meaning, discovery
Basic elements of analysis – numbers and statistical analyses	Basic elements of analysis – words and narrative
Single reality that can be measured and generalized	Multiple realities that are continually changing with individual interpretation

Table 3.1 Characteristics of Quantitative and Qualitative Research Methodologies

3.3.12 In this study the data from each of the different phases was analysed from both a qualitative and a quantitative perspective, as illustrated in table 3.2 below.

Phase of research	Perspective of Analysis
Semi Structured Interviews	Qualitative/Quantitative
Questionnaire	Qualitative/Quantitative
Comparative Intervention	Quantitative

Table 3.2 Analysis of data

3.5 **Position and the ethical stance of the researcher**

- 3.5.1 The position of the researcher varied throughout each of the three phases of this research, and we now turn to each separate phase of the study to assess how this could have had an impact on the results.
- 3.5.2 Throughout the semi-structured interviews, it was unavoidable that the role of the researcher would impact on the interviews, as throughout, the researcher was in direct contact with participants. It was inevitable that the perception participants had of the researcher would in some way influence responses given. However this was of little concern as the focus of the interviews was to generate hypotheses as opposed to testing an existing hypothesis.
- 3.5.3 Had the interviews been more ‘structured’ to test *existing* hypotheses, then the way the researcher was perceived could have been more problematic. In this respect, throughout the preliminary phase of this research, I considered that my role was to encourage participants to discuss general aspects of involvement musical activities, and the ways in which they perceived these could possibly affect speech and language in individuals with ASC. Participants in turn would hopefully have perceived my role as a neutral observer, attempting to gather information, as opposed to coming to the interviews with preconceived notions about the role of music in the lives of individuals with ASC and the effects this might have on speech and language.
- 3.5.4 Analysis of data was qualitative in that the comments were reported in the form of a narrative, and from a quantitative perspective in that comments were analysed within

the context of a model devised by Ockelford (2013), to ascertain the impact that involvement with music has on children (either with special needs or developing neurotypically) with regard to music in its own right, and an earlier model (Ockelford, 2013) within the context of ‘music to inform wider learning and development’ (see 4.2.9 and 4.2.12).

3.5.5 With regard to the questionnaire, a standard letter, written by the researcher asking individuals to answer the questionnaire was used, whether the institution contacted was a school, a charity, or some other organisation connected with individuals with ASC. The wording of the letter could nevertheless have influenced the responses given by respondents in that due to the wording of the letter, the respondents could have had a preconceived notion of why the research was being carried out. If participants had not been informed that the questionnaire was carried out within the context of academic research, as with the semi-structured interviews, responses could again have been different.

3.5.6 Analysis of data was qualitative in that results were reported in the context of descriptive data, and quantitative in that results were also reported with regard to how the different variables appeared to affect one another.

3.5.7 With regard to the comparative intervention, the researcher was present throughout every session, and was responsible throughout all the sessions in giving instructions to the participants. This could have influenced results in that had there been another person overseeing the sessions, then participants may have reacted in a different way. Because of this, every effort was made to keep to the same procedure. However due

to the context within which the research took place – i.e. within special schools or mainstream primary schools on a normal working day, some variation was inevitable with regard to where exactly the sessions took place, and which members of staff were available to act as research assistants. Furthermore different activities throughout the school day that pupils were involved in would undoubtedly have put them in different mind-sets for the time that they spent participating in this research.

3.5.8 With regard to the overall design of the comparative intervention, this phase had a repeated measures design. The aim was to establish how singing could impact on verbal recall for both children with ASC and also neurotypical children. It was not the intention of the researcher to compare results *between* the two different groups, due to the non-uniformity of both groups. The rationale behind the design was instead to take each group independently and compare how verbal recall could be influenced by the presence or absence of music, and then answer the same research questions with each group in relation to how singing affects verbal recall.

3.5.8 In the event, a decision was taken not to use inferential statistical tests to assess the significance of difference within groups across the different conditions, as the effects of the presence or absence of music for the children with ASC were so diverse. For some children the presence of music greatly enhanced verbal recall, for some children there was little effect, and for others the presence of music had a negative effect on verbal recall. A decision was thus taken to track the individual journey of the children throughout each condition as opposed to attempting to analyse the effects of music on verbal recall on the group as a whole. Results and the analysis of data are discussed in detail in chapter 6.

3.5.9 The comparative intervention was carried out within the paradigm of experimental psychology, in that the researcher was attempting to ascertain the effect of the independent variable (singing) on the dependent variable (verbal recall) in an attempt to further inform models to explicate the relationship between music and language for individuals with ASC.

3.5.10 There are certain ethical concerns that arise in carrying out this type of research, and we now turn to the different phases of this research in turn to address such issues. A more detailed account of which measures were taken to address such issues can be found in Appendix 2 (p.xxx) in the Ethics Application Form. This is a standard form issued by the University of Roehampton that has to be completed and assessed by the University's Research Department before permission is granted for any research to take place.

3.5.11 With regard to the semi-structured interviews, issues arose with regard to confidentiality. Participants were informed that no individual discussed within the context of the interviews would be identifiable. Furthermore all interviews were recorded on a Minidisc and then transferred into WAV files and stored on a password protected PC. All Minidisc recordings were subsequently destroyed. Participants were informed before the interviews took place of their right to withdraw from the research at any time, and also of their right to have any collected data deleted from the study at any point in time.

- 3.5.12 Concerning the questionnaire, this was presented in such a way that the right of the participant to withdraw themselves and their data from the research at any stage was made clear. Participants were also informed that information from any individual question would remain confidential, and that at all times the anonymity of the participants would be preserved at all times. At no time were any participants sent a questionnaire form. Instead they were informed that the questionnaire was available to fill in through the web page www.surveymonkey.com and a link was included in the standard letter sent out to the various schools, charities and other organisations that work with individuals with ASC.
- 3.5.13 With regard to the comparative intervention, all sessions were video recorded. As a result of this, children's faces were clearly visible and therefore identifiable to the researcher and the supervisors of this study. Because of this the videos will not be used in any presentations or conferences in which the study might be included, and consequently all video files were destroyed after completion of the study.
- 3.5.14 The researcher acknowledged that certain issues arose in working with individuals with ASC who have difficulties with language, and may not have enough understanding to know what is happening to them. Consequently, teachers at the schools involved were asked to explain to the participants, as far as possible, the nature of this research. According to the individual needs of each child, additional strategies were employed, such as the PECS (Picture Exchange Communication System) and the signing language Makaton, to help the participant become more aware of the proceedings involved in carrying out the comparative intervention.

3.5.15 All results were reported honestly and precisely, and the publication of results complied with the Data Protection Act, 1998. It was agreed beforehand that if at any stage a child became distressed the researcher would stop the session and seek to reassure the child. If the distress was not reduced the researcher would ask the teacher or teaching assistant to withdraw the child from the research. At no time was any session carried out with an unattended child.

3.6 **Concluding remarks**

- 3.6.1 The thinking behind the design of the study as a whole was that results from the semi-structured interviews would inform a questionnaire which could then be tested on a much larger population to assess the validity and generalizability of this earlier data. It was envisaged that the results of the questionnaire would also define both the dependent and independent variables that could subsequently be employed within a comparative intervention to better understand how these variables relate with one another.
- 3.6.2 Ultimately, individuals with ASC comprise a vastly diverse population. As such we should not lose sight of the fact that any generalisation to be made will always be somewhat inexact as no two individuals with ASC will ever share the same prognosis.

Chapter 4: Preliminary Study

4.1 Introduction

- 4.1.1 In this chapter, we turn to the first phase of my study, consisting of semi-structured interviews that took place towards the end of 2010. It was hoped that such interviews would produce a rich source of data from a relatively small population that could subsequently be used to inform the design of the questionnaire. As Cohen says (2011: p.145), ‘Semi-structured interviews allow informants the freedom to express their views in their own terms. They can provide reliable comparable qualitative data.’

4.2 Methodology

- 4.2.1 Questions to be included within the semi-structured interviews were designed in order to gain information on how (if at all) parents, teachers, carers and music therapists had noticed that exposure to different types of music, or involvement in different types of musical activities, may enhance communication skills for children or young people with autism.
- 4.2.2 The participants in the semi-structured interviews were as follows:
- 3 music therapists working with children with ASC in special education settings
 - 3 teachers of pupils with ASC in special education settings
 - 4 carers of individuals with ASC in hostels and private homes
 - 2 parents of children with ASC

- 4.2.3 These participants were intended to be broadly representative of the adults who typically have contact with children with ASC, at home and in residential and educational settings. All of the interviews were carried out in Cornwall, close to the researcher's home, to minimise travel costs.
- 4.2.4 Participants were interviewed at venues that were convenient for them, and where it was thought that they would feel comfortable in expressing their opinions. The interviews were recorded using a Sony minidisc recorder and microphone. Recordings were subsequently transferred to the software package 'Cubase' to facilitate the process of transcription and were then digitally stored on a password-protected home PC in mp3 format. The interviews lasted between 15 and 20 minutes - sufficient to gain enough information to help formulate questions for the questionnaires, whilst not imposing too much on those involved.
- 4.2.5 Questions to be asked were either general, or related more specifically to music. General questions included asking about the gender and age of the children with ASC, as well as the character of the child concerned and whether he or she had any particular likes or dislikes. The general questions were employed primarily as 'warm-up' questions to put participants at their ease, and were comprised from the following:
- Briefly can you tell me a little bit about your child...name,(boy or girl), how old etc.?
 - What's he /she like (outgoing/introverted/full of energy/loud/quiet...)?
 - In terms of activities any particular likes or dislikes?

4.2.6 Questions relating more specifically to music had the following foci:

- listening to music
- making music
- making up music
- music in other contexts

4.2.7 With regard to listening to music, participants were asked the following questions:

- Does your child listen to music (for its own sake)?
- How long for?
- In the car? With friends?
- Would there be any purpose for playing music to them, to keep them quiet? To calm them?
- To keep them occupied?
- What type of music?
- Any preferences? Vocal/ non- vocal?
- Can you think of other ways that your child may be exposed to music?
- (ie computer games, TV, radio,) Go through a typical day.
- Do they have the opportunity?
- When would they listen to music?

With regard to making music, participants were asked whether their children ever sang, whistled, hummed or played an instrument and, if so, when this occurred and what genre they sang or played. Questions asked with regard to making music were comprised from the following:

- Does your child sing/whistle, hum, play?
- When and what?
- What instrument (if relevant)? Tell me about it...
- Does your child sing songs with words?
- When and what?
- Does your child find it easier to produce the music from songs with words (as opposed to instrumental pieces of music) in terms of singing humming, or singing on 'la'?
- Does your child imitate or respond in any way to everyday sounds?

4.2.8 With regard to children making up music or creating their own pieces, participants were asked the following questions:

- Does your child make up his/her own pieces?
- Would this involve singing or playing?
- If singing, would this involve words?

Finally questions to be included in the interviews with regard to music in another context were as follows:

- Do you think that language your child has learned from songs can be useful in other non-musical situations? Can you tell me about it?
- Can certain songs be representative or symbolic of 'other everyday activities' for your child? Can you tell me about them?

- Would your child be more likely to understand the words of a song if it involves actions of some sort?
- How much of the language your child learns through song does h/she understand?

4.3 Qualitative and Quantitative analysis of data

Within the preliminary study, data is analysed both from a qualitative perspective and from a quantitative perspective, before the implications of the data are discussed with regard to how the data could inform a questionnaire that could be carried out on a larger scale to test the generalizability of the results.

4.3.1 Qualitative analysis of data

As far as the current research is concerned, the most important theme to emerge from the data was that children with autism sing. One teacher believed that participation in music for some children with ASC could take away the feeling of anxiety associated with speech and communication. She described how

‘Speaking can be quite a big deal if you haven’t done it until you’re six. It can be a really big deal...Through something that’s fun and enjoyable and the onus is taken off you to say the word. If you just do it through fun, and that I think is what music holds for our kids, it’s really highly motivating’.

- 4.3.2 The teacher also described how one of her pupils with limited language would learn lyrics to songs all the way through, stating that,

‘You know, one of my, one of my little girls from the year before last...she...a couple of them actually learned a whole song, by rote, you know, she had very few, probably like 30 to 40 words that she would use functionally...to ask for things, but in, you know, she knew every word to every pop song we learned together, to the point where she’d sing it all the way through. So I think, you know if they enjoy something and they’re motivated by it and it means something to them and it becomes something they enjoy.’

4.3.3 These findings are in accordance with those of Edgerton (1994: p.55), who believed that communication through music can enhance communication for individuals with autism, as communication through music ‘bypasses the speech and language barriers of autistic people’. (see 3.5.2.4)

4.3.4 An example of how involvement in musical activities can elicit vocal sounds in a musical sense was given by one of the music therapists. Describing how some children with ASC that he worked with responded to songs, he described how,

‘particularly with popular songs - popular children’s songs...‘Twinkle twinkle little star,’ ‘Row, row, row the boat,’...‘Nick nack paddywack,’ –these are songs they’ve been used too, probably all their lives, and that always, no, it doesn’t always elicit a response, but very often the child, the young person, will hum along to that, or groan along with it (demonstrates to the tune of Twinkle twinkle little star), because it’s no, they don’t understand.’

4.3.5 This finding accords with the views of Ockelford (2013: p.92), who wrote that some children with ASC who find verbalising difficult ‘may nevertheless be able to communicate by singing words and phrases, or at least intoning them with a rhythmic structure.’

4.3.6 The second key finding (which did not relate directly to the research questions) was the perception that music can enhance social relationships. As the carer of a girl said,

‘With the right individuals who enjoy music as well, it helps form social links for her.’

4.3.7 One of the music therapists believed that music could help develop social relationships for individuals with ASC, stating that,

‘I think cos language comes from the need to interact and to communicate and to be human with somebody, you know, if you’re working on that preverbal level and using sound and rhythm and movement and things to connect with someone, then the language comes from that I think, and that’s where the music comes in.’

4.3.8 In a similar way, another music therapist explained how music enhanced the relationship with one of his clients, stating that,

‘there’s something very interesting about Jake, which is why I’ve worked with him for nearly two years now...I’d say his interactions with me have grown from a notional 3% of the time

interaction to about 40% of the time. But what's interested me about Jake is that...sometimes I get the feeling that he really, really wants to interact with me. The tensions that you can create in music, the harmonic tensions have a, have a physiological effect on Jake and I can see his facial expression.'

4.3.9 The third music therapist discussed how music was a good medium to encourage interaction. Asked if he thought music could enhance language, he replied,

'I think just that, it's almost like you're building the basis, the foundation for verbal language, because you're sort of developing relatedness, and a flow backwards and forwards of, sort of...not verbal communication, but you know...musical communication. And I think that's the sort of starting point almost. So even if there's no words at all, you're...it's almost like call and response. I mean that's one example.'

4.3.10 Finally, several participants commented on how words learned in songs crossed over into real-life situations. For example, a teacher said,

'I think that talking of children in general, it's undoubted that music is, you know, has a great importance really in being able to...transfer language to another...experience or context, and I think also it's a very good way of repetition and rote learning...Helps children to memorise information and therefore can cross over into different contexts once you start teaching that language in another

context or using that language in another context, there'll be the memory link.'

4.3.11 Similarly, another teacher explained:

'Yes as I say, the ones that's been here four years has started using some words in context, so you know, occasionally it has shown through, that words learned in song can cross over.'

4.3.12 A music therapist said,

'I'm absolutely convinced that...the use of these words supported by the music can actually spill over into their outside world. In fact I've had reports from teachers here, saying that...'Oh Yeah, he's been using this word.' He was using the word toothbrush for example, the other day, which he had learned from the songs. So I think the answer's yes to that. Language picked up in songs does cross over into every day outside of song.'

4.4 Quantitative analysis of data

4.4.1 We now turn to the quantitative analysis of the data. With regard to this, all responses were manually transcribed. Responses pertaining to 'music in its own right' were encoded within the context of the 'Sounds of Intent' ('Sol') model, (Welch et al. 2006).

4.4.2 The SoI framework categorises musical engagement as existing in one or more of three domains:

Reactivity : Listening and responding

Proactivity : Causing, creating and controlling sounds

Interactivity : Listening to and making sounds with others

4.4.3 In the SoI model, these categories are represented as three segments of a circle and expressed over six levels. However, in terms of analysis of the data to emerge from the semi-structured interviews, categorisation merely took into account domain (rather than level).

4.4.4 Responses pertaining to ‘music to inform wider learning and development’ were encoded within the context of an earlier model devised by Ockelford (2000: p.200). The categories within this model are:

Music and Learning

Music and Socialisation

Music and Communication

Music and Movement

4.4.5 Quantitative analysis of comments made with regard to music in its own right

4.4.5.1 Reactivity

	Carer N=4	Parent N=2	Teacher N=3	Music Therapist N=3	TOTAL
Preferences	18	17	20	6	61
Context	8	2	4	4	18
Negative reactions	5	5	3	0	13
Responds to everyday sounds	5	0	3	1	9
Physiological Reactions	0	0	2	5	7
SUMS	36	24	32	16	108

There were in total 61 comments made with reference to children with ASC expressing a preference to either specific artiste or a particular genre of music. There were 18 comments made with reference to context within which music took place and 13 comments made with reference to an adverse reaction to music.

4.4.5.2 Interactivity

	Carer N=4	Parent N=2	Teacher N=3	Music Therapist N=3	TOTAL
Claps to music	2	3	0	0	5
Plays back musical sequence	0	2	0	0	2
Plays back rhythmic sequence	4	3	1	1	9
Resolves Chord	0	0	0	3	3
SUMS	6	8	1	4	19

With regard to interactivity to music, there were 14 reference made with regard to interactivity and rhythm. Five comments were made with regard to children clapping to music and nine comments made with regard to children playing back a rhythmic sequence. There were just two comments made with reference to playing back a musical sequence and three comments made with regard to resolving a chord.

4.4.5.3 Proactivity

	Carer N=4	Parent N=2	Teacher N=3	Music Therapist N=3	TOTAL
Sings verbally or non-verbally	23	7	17	14	61
Plays a musical instrument	13	2	6	15	49
Improvises	8	1	6	13	28
SUMS	49	11	32	46	138

There were in total 61 comments made referring to the fact that children with ASC sing either verbally, or non-verbally. There were 25 comments referring to the fact that children produce vocal sounds in a musical sense, 18 comments referring to children singing with some element of understanding the words, and 18 comments referring to children singing with no understanding of words.

4.4.5.4 Quantitative analysis of comments made with regard to music to inform wider learning

4.4.5.5 Music and Learning

	Carer N=4	Parent N=2	Teacher N=3	Music Therapist N=3	TOTAL
Music aids memory	1	0	1	0	2
Music helps focus	0	0	1	0	1
Music symbolises activities	5	2	9	10	26
Visual stimuli with music enhances word acquisition	1	8	4	0	13
Uses words in real world situations	2	1	2	4	9
Music helps to understand the world	2	6	6	2	16
SUMS	11	17	23	16	67

With regard to music and learning, one finding to stand out was that there were 26 comments made referring to music symbolising activities – that is to say music being employed as a symbol to represent some activity that a child associates with a particular piece of music.

4.4.5.6 Music and Socialisation

	Carer N=4	Parent N=2	Teacher N=3	Music Therapist N=3	TOTAL
Exposed to music in a social content	1	0	0	0	1
Exposed to family influences	3	3	0	1	7
Music helps to develop relationships	2	1	1	9	13
Music enhances shared activities	1	0	3	4	8
Experiences defining moments in music	0	2	0	1	3
SUMS	7	6	4	15	32

With regard to music and socialisation, 13 comments were made with reference to how music can help to develop relationships, and a further 8 comments were made in reference to how music can enhance shared activities.

4.4.5.7 Music and Communication

	Carer N=4	Parent N=2	Teacher N=3	Music Therapist N=3	TOTAL
Uses music to interact	5	2	4	14	25
Music initiates eye contact	0	0	2	4	6
Live music promotes interaction	0	0	1	0	1
Plays instrument with other person	5	0	0	0	5
Melody encourages communication	0	0	2	0	2
Rhythm encourages communication	0	0	4	0	4
Music helps word comprehension	4	1	1	1	7
Produces vocal sound to communicate	2	0	0	4	6
SUMS	16	3	14	23	56

The stand out finding with regard to music and communication was that there were in total 25 comments made with reference to the fact that individuals with ASC use music as a vehicle to interact.

4.4.5.8 Music and Movement

	Carer N=4	Parent N=2	Teacher N=3	Music Therapist N=3	TOTAL
Likes actions in songs	1	0	0	0	1
Spins/dances	1	2	0	1	4
Taps to music	0	0	1	2	3
Rocks to music	0	0	1	0	1
SUMS	2	2	2	3	9

There were only 9 comments in total with regard to music and movement, which in total was less than 2% of all comments made. Comments were evenly spread across the categories of interviewees.

4.5 Conclusion

4.5.1 To conclude, the interviews were primarily carried out to inform the design of the questionnaire. Analysis of data was both qualitative and quantitative. Qualitative analysis was carried out in an attempt to identify themes and to generate research questions that could then be tested for validity through the employment of a questionnaire sent out to a much larger population. Qualitative analysis was also carried out to identify any themes or topics to emerge that the researcher had not previously considered. In this respect two themes emerged whereby respondents wanted to discuss music and social relations, and the way words children learned from songs might be used in real life situations. These two themes generated two additional questions for the questionnaire. These questions were:

- 1) Can music enhance relationships for children with ASC?
- 2) Can words learned from a song cross over into real life situations?

4.5.2 Analysis was also quantitative in that it was hoped that data from the interviews would be of some interest in their own right, and in this way also complement both the questionnaire and the comparative intervention.

4.5.2 In sum, the main findings, in the view of the interviewees, were as follows:

- children with ASC sing
- music can enhance relationships for these children
- words learnt from song can cross over into real life.

Chapter 5: Questionnaire

5.1 Introduction

- 5.1.1 In this section, methodological issues pertaining to the questionnaire are discussed, and the results are analysed. The dichotomous and multiple-choice ‘closed questions’ from the questionnaire are analysed quantitatively, in terms of how responses relate to research findings from the field, how responses relate to the research questions in this study, and how responses support or contradict findings from the semi-structured interviews.

The research question relating to the questionnaire is as follows:

- Does the co-existence of melody with a string of words make the words and music easier to learn and reproduce for children with ASC?

5.1.2 Additional findings to emerge from the pilot study:

Observation 1:

Can words children with ASC learn from songs cross over into everyday activities?

Observation 2:

Can involvement in musical activities enhance social relationships for children with ASC?

5.2 Methodology

5.2.1 Issues with online research

5.2.1.1 The questionnaire was undertaken using www.surveymonkey.com Survey Monkey enables researchers to place a questionnaire online and send links to potential participants to complete the survey. The advantages and disadvantages of carrying out research online are discussed below.

5.2.1.2 Advantages of online research

Fowler, (2009: p.286) cites some of the advantages of online research as follows:

- it reduces cost
- it enables a wider and larger audience to be reached
- it enables the researcher to reach difficult populations under the cover of anonymity and non-traceability
- respondents choose when and where to complete
- respondents can complete the survey over time
- research suggests that web-based surveys show fewer missing entries than paper-based surveys
- human error is reduced when entering and processing online data
- greater generalisability may be obtained as internet users come from a wide and diverse population.

Furthermore it could also be argued that internet users comprise a diverse population.

5.2.1.3 *Disadvantages of online research*

Glover and Bush (2005: p.276) cite a number of disadvantages of online questionnaires, including the following:

- respondents may want to withhold their identity from the researcher; thus, non-traceability of respondents may be problematic.

To counter this problem, in an attempt to give potential participants confidence in the current study, all initial e-mails to prospective respondents clearly explained that the research was part of a PhD at the University of Roehampton. Furthermore, contact details of the researcher were made available to participants, should they have wished to check that the survey was authentic.

5.2.1.4 Another disadvantage with online research according to Glover and Bush is that:

- the configuration of the questionnaire could vary from one machine to another.

To counter this, www.surveymonkey.com questionnaires are designed to appear in the same format across different platforms. Once the design of the questionnaire was completed, it was opened by the researcher on several platforms to ensure that all questions and spaces for answers were visible and fully accessible; no issues were found.

5.2.1.5 A further disadvantage of online research identified by Glover and Bush is that:

- respondents may be unfamiliar or inexperienced with the Internet.

To counter this, the design of the questionnaire was kept as simple as possible. In case respondents were not used to pull-down menus or drop-down boxes, these were avoided in the design. Furthermore, to promote higher levels of completion, respondents were able to progress from one screen to the next, even if the current screen had not been completed. One disadvantage of this, however, was that sections of the questionnaire could be left blank.

5.2.1.6 Finally, Glover and Bush suggested that:

- respondents may get bored and drop out before completing the survey.

To counter this problem, the number of questions was kept to a minimum. All questions were worded as simply as possible, to make them more easily understood, in an attempt to increase the likelihood of participants completing the survey.

5.2.2 Ethics

5.2.2.1 The purpose of the questionnaire was made clear to all participants. At no stage of the research did respondents receive a questionnaire unless they expressed a willingness to participate in the research. Furthermore, the questionnaire was presented in such a way that the right of participants to withdraw themselves and their data from the research at any point was evident.

5.2.2.2 Every effort was made to ensure that information gained remained confidential and that the anonymity of the respondents was preserved. Data were never used or presented in a judgemental way.

5.2.2.3 At no stage were the names of any participants disclosed. The identities of respondents were known only to the researcher.

5.2.3 Rationale behind the inclusion of different question types

5.2.3.1 The questionnaire employed two different types of questions:

- Dichotomous Questions
- Multiple-Choice Questions

5.2.3.2 Dichotomous Questions

Dichotomous questions require a ‘yes’ or ‘no’ answer. According to Cohen and Manion (201: p.383),

‘The dichotomous question is useful, for it compels respondents to ‘come off the fence’ on an issue. It provides a clear and unequivocal response. Further, it is possible to code responses quickly, there being only two categories of response’.

5.2.3.3 According to Weems *et al* (2003: p.312) disadvantages of dichotomous questions include the risk of building in respondent bias in that ‘people may be more reluctant to agree with a negative statement than to disagree with a positive statement’.

Another problem may be that ‘a “yes” or “no” answer may be inappropriate for a situation whose complexity is better served by a series of questions which catch that complexity’ (Cohen and Manion 2011: p.384).

5.2.3.4 To reduce the risk of respondent bias, dichotomous questions were always followed by multiple choice questions. For instance, one dichotomous question used in the questionnaire for this study is: ‘Does your child sing’; this is followed by a multiple-choice option asking how many hours the child sings for and a further multiple-choice question asking what level the child sings at.

5.2.3.5 Multiple Choice Questions

An advantage of multiple-choice questions is that responses can be coded and analysed quickly. They are more complex than dichotomous questions in that a *range* of choices can be set out to capture the likely range of responses to given statements.

5.2.3.6 One issue with multiple-choice questions is that if the wording is ambiguous respondents can easily make an incorrect response. According to Cohen and Manion (2011: p.384), ‘This is the heart of the problem of questionnaires – that different respondents interpret the same words differently’. To counteract such ambiguity, as mentioned above, the wording of the questions was kept as simple as possible. Furthermore, every effort was made to ensure that all categories were discrete. Additionally, a pilot questionnaire was run (as discussed below) and no issues were found.

5.2.3.7 With regard to the level of children’s singing (question 7), and whether or not children possessed absolute pitch (question 8), questions to be included in my study were taken from Focus on Music (Ockelford and Matawa 2008: p.115)

5.2.4 Respondents

5.2.4.1 Respondents targeted for the questionnaire were parents, teachers, carers and music therapists who had individuals with ASC in their care, or who were working with them. Respondents were located through a customised e-mail sent to a range of schools, charities and organisations involved with individuals with ASC. The email explained that the questionnaire was part of a doctoral study looking at the effect of music on language for individuals with ASC, and it requested potential respondents to access and complete the questionnaire on line through the Survey Monkey website.

5.2.4.2 Around 150 responses were collected through the National Autistic Society's UK regional branches. A further 50 were gathered from three special schools in the London borough of Fulham, which, had previously shown interest in participating in research being carried out by the University of Roehampton. The remaining responses came from other schools, charities or organisations offering services to children and young people with ASC, both in the UK and abroad.

Responses were collected from the following countries:

UK	183
USA/Canada	35
Europe	16
Rest of World	14
Unknown	72

N=320

5.2.5 Schedule

5.2.5.1 The questionnaire was designed between March and June 2011 and a pilot study was then carried out in August of the same year, via e-mail. The pilot study was completed by two music therapists, two teachers and two carers, who all confirmed that the questions were clearly set out, and that there were no issues arising, either conceptually, or technically, with the provision of answers. The questionnaire was then placed on line, via Survey Monkey, from September 2011 until January 2014.

5.2.6 Design of the Questionnaire

5.2.6.1 In this section, the rationale behind the questions is discussed. A full version of the questionnaire as it appeared on the Survey Monkey web site can be found in appendix 7.

Q1: Gender of child

The first question concerns gender. This question was included to ensure that the sample was broadly representative of the gender balance in the population as a whole. A second reason was to ascertain the potential impact of gender on language acquisition and use in children with ASC, the ways in which language affects music, whether words learnt from song might cross over into everyday life, and whether music can enhance relationships.

5.2.6.2 *Q2: Nature of special needs*

Respondents were asked to summarise the nature of their children's special needs. This question was included to identify any difference in the way exposure to music

affects linguistic abilities for both ‘high-functioning’ and ‘low-functioning’ children with ASC.

5.2.6.3 *Question 3: Level of Speech*

Respondents were asked: how would you describe the level of your child's speech?

A multiple-choice question was employed to reflect the wide range of linguistic abilities of children on the autistic spectrum. The level of linguistic ability was considered important, in that differences might significantly impact upon the relationship between music and language for children with ASC.

Respondents were asked to tick one or more boxes pertaining to the following categories:

- Non-verbal
- Uses words singly or in pairs
- Echolalic (copies words she/he hears with little apparent understanding)
- Speaks at a level one would consider appropriate for his or her age

5.2.6.4 *Question 4: Level of Understanding*

Respondents were asked to rate their children’s level of understanding of speech.

They were asked to tick one or more boxes, pertaining to the following categories:

- Little or no understanding
- Some understanding but not at a level one would consider appropriate for his or her age group
- Understands language at a level one would consider appropriate for his or her age group

This question was included to ascertain the extent to which a child's level of linguistic understanding may affect the relationship between music and language for children with ASC. Again a multiple-choice format was employed to reflect the range of receptive linguistic skills within the population of children on the autism spectrum.

5.2.6.5 *Question 5: Does your child sing?*

Parents were asked whether or not their children sang. This question was included to determine whether the presence or absence of singing has an impact on how music affects language and communication and, also how language affects the musicality of children with ASC.

5.2.6.6 *Question 6: Hours a day spent singing*

Respondents were asked how many hours per day, on average, their children sang. This question was included to ascertain whether the extent to which children sang has an impact on the relationship between music and language for children.

5.2.6.7 *Question 7: Level of children's singing*

If a respondent reported that a child with ASC sang, in an attempt to ascertain the level of a child's singing respondents were asked to rate the level in respect of the following categories:

- Not as advanced as one would expect for a child of his or her age
- About what one would expect for a child of his or her age
- More advanced than one would expect for a child of his or her age
- Don't know

5.2.6.8 *Question 8: Absolute Pitch*

This question was included to ascertain the impact that absolute pitch may have on the relationship between music and language for children with ASC. Respondents were asked, ‘Does your child have absolute pitch? For example, does your child know the names of musical notes just by listening to them, or does he/she always sing pieces in the same key?’

5.2.6.9 *Question 9: Singing without words*

Respondents were asked, ‘Does your child ever sing without words (humming, ‘la-ing’ or whistling, for example)?’

Respondents were asked to tick one of the following boxes:

- Always
- Sometimes
- Never

This question was included to ascertain the potential impact of ‘whether or not children sing non-verbally’ on language acquisition and use in children with ASC.

5.2.6.10 *Question 10: Are words learnt from songs being used in real-life situations?*

Respondents were asked, ‘Have you noticed any instances where your child has learnt a word in a song and applied that word in a real-life situation? This question was included to ascertain the extent to which words learnt through songs cross over into real life for children with ASC, and whether this impacted upon the way music affects language for this population.

5.2.6.11 *Question 11: Exposure to music to understand language*

Respondents were asked, ‘Do you ever use songs to try to help your child understand or use language?’ The question was dichotomous, requiring a yes or no answer. This question was included to establish whether or not parents, teachers or other adults involved in the care of children with ASC used music to help augment receptive language skills for children with ASC, and to ascertain the impact this may have on receptive language skills.

5.2.6.12 *Question 12: Singing to express emotion*

Respondents were asked, ‘Does your child ever sing to express emotion, to express needs, or to make specific requests?’ This dichotomous question was included to ascertain the extent to which singing to express emotion may impact upon the relationship between music and language for children with ASC.

5.2.6.13 *Question 13: Music helping relationships*

Respondents were asked, ‘To what extent would you say engagement in music has helped your child develop relationships with other people? (For instance helping the child to become more aware of another person's actions, or motivating a child to join in shared activities over time?)’ Respondents were given a choice of the following responses:

- Not at all
- A very little
- Somewhat
- A lot
- Very much so

- Don't know

Having now described the rationale behind the questions in the questionnaire, in the next section we will discuss the responses and the descriptive statistics and cross-tabulations between subgroups within the sample.

5.3 Descriptive statistical findings

In this section, the data from the questionnaire are presented and discussed with reference to questions on an individual basis.

5.3.1. *Q1: Gender of child*

With regard to gender of the children, 79% of the children were male and 21% were female (N=320). This accords with data from the National Autistic Society (NAS) of the UK, which indicates that the ratio of males to females diagnosed with ASC is 4:1 www.autism.org.uk Hence, the sample can be considered to be broadly representative in this regard.

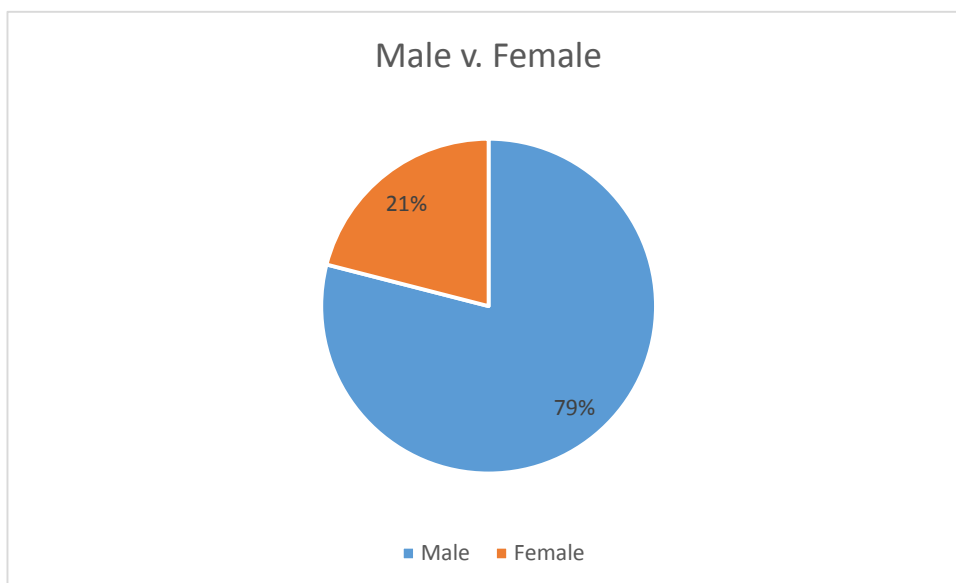


Figure 5.1 Gender of child N = 320

5.3.2 *Question 2: Nature of special needs*

5.3.2.1 Responses fell into two distinct groups consisting of children who were described as having ASC (80%) and those who were said to have Asperger's syndrome (20%).

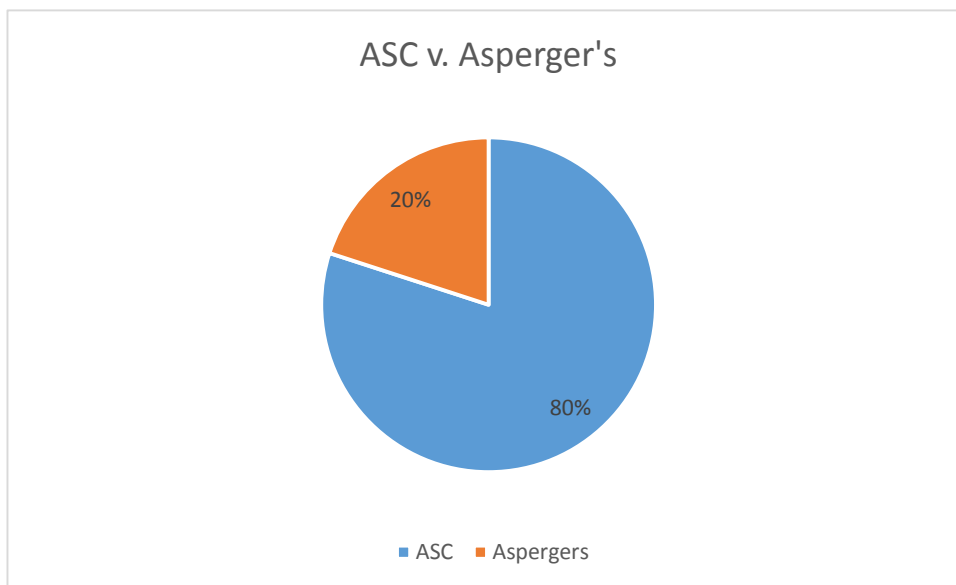


Figure 4.2 Nature of special needs n = 306

5.3.2.2 As we shall see, because of potential confusion in the way these terms are used (people with Asperger's syndrome are also on the autism spectrum), the proportion of children and young people with Asperger's Syndrome may have been under-represented.

5.3.3 *Question 3: Level of Speech*

Participants were asked to tick one box or more, which in hindsight, complicated the analysis of the data. Forty-four respondents ticked two categories: single or two-word sentences and echolalia. As both these categories are indicative of language delay, a decision was made to re-classify these responses under a new category: ‘some language delay’. A further eight respondents ticked both ‘echolalia’ and ‘speaks at a level one would consider appropriate for his or her age’. As these responses indicated that children *could* speak at an age-appropriate level, all eight responses were reclassified as ‘speaks at a level one would consider appropriate for his or her age’.

5.3.3.1 The four original categories were thus collapsed into three categories:

- Non-verbal
- Some language delay (including echolalia)
- Speaks at a level one would consider appropriate for his or her age

A further decision was made to discard any response where three or more boxes had been ticked, since this was thought to show a potential misunderstanding of the question.

5.3.3.2 Data from the reclassified categories show that 18% of the children were described as non-verbal, 41% were described as having some language delay and a further 41% were described as speaking at an appropriate level for their age. Therefore, 59% of children were judged not to be using language at an age-appropriate level.

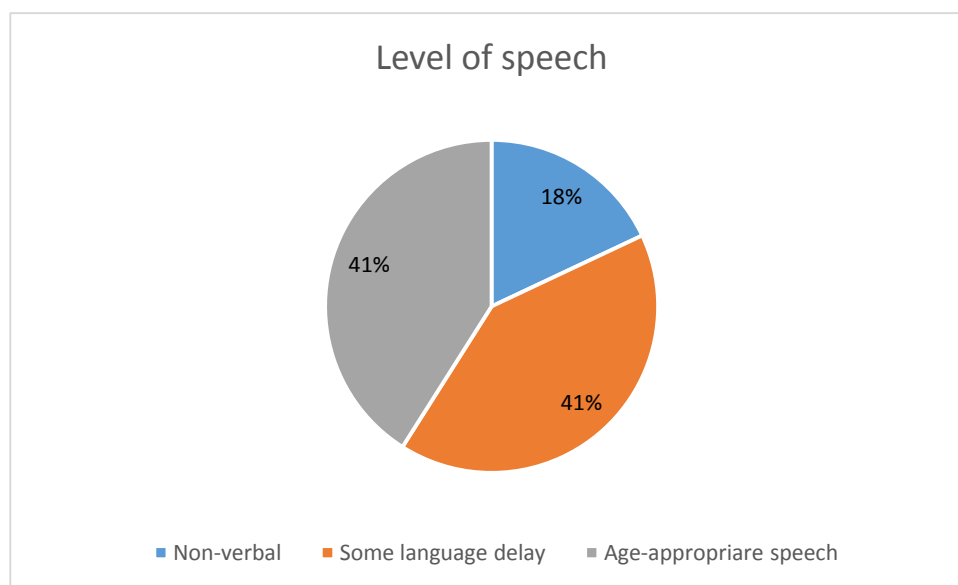


Figure 4.3 Level of speech n=275

5.3.4 *Question 4: Level of Understanding*

A total of 7% of children were reported to have little or no understanding of language, a further 65% of the children had some understanding, but not at a level one would consider appropriate for their age, and the remaining 28% of children understood language at a level that one would consider appropriate for their age.

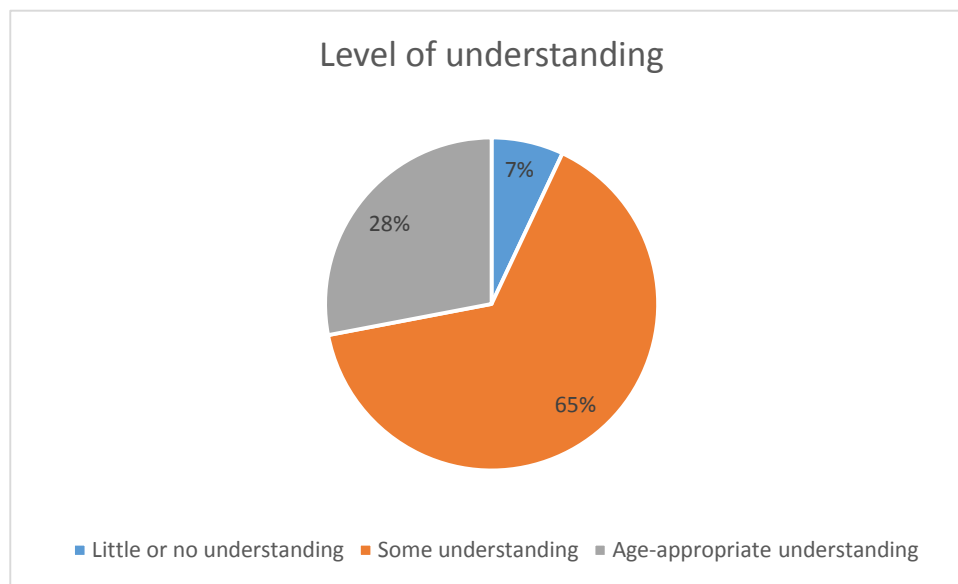


Figure 4.4 Level of understanding N=320

5.3.4.1 Respondents reported that 65% of the children with ASC have age-appropriate understanding, whereas 41% children have age-appropriate speech. This accords with the expectation that receptive language will be more advanced than expressive language. Berk (2009: p.175) reported that 'Receptive language development (the ability to comprehend language) usually develops faster than expressive language (the ability to communicate).'

5.3.5 *Question 5: Does your child sing?*

5.3.5.1 With regard to the prevalence of singing in children with ASC, it was reported that 74% of children sang and 26% did not. The context and extent to which children with ASC sing is discussed below

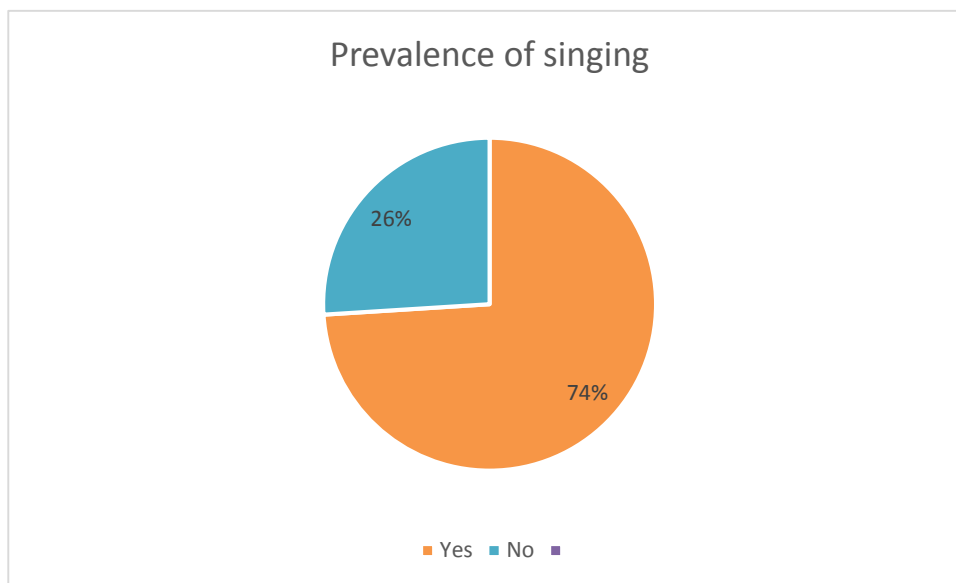


Figure 4.5 Prevalence of singing n=315

5.3.6 *Question 6: Hours a day spent singing*

5.3.6.1 With regard to hours a day spent singing, it was reported that 66% of children with ASC sang for less than one hour a day, 22% of children sang for one to two hours a day, and 12% of children sang for more than three hours a day.

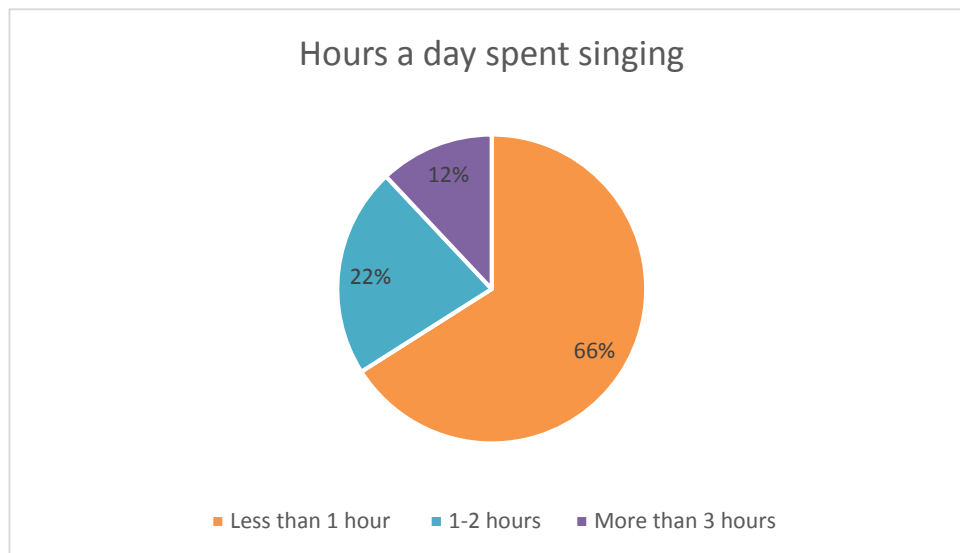


Figure 4.6 Hours a day spent singing n=266

5.3.7 *Question 7: Level of children's singing*

5.3.7.1 With regard to the level of children's singing, it was reported that 48% of the children sang at a level that was not as advanced as expected for their age, 27% of children sang at the expected level for their age, and a further 12% sang at a level that was considered more advanced than expected; 13% of respondents reported that they did not know the level at which their children sang.

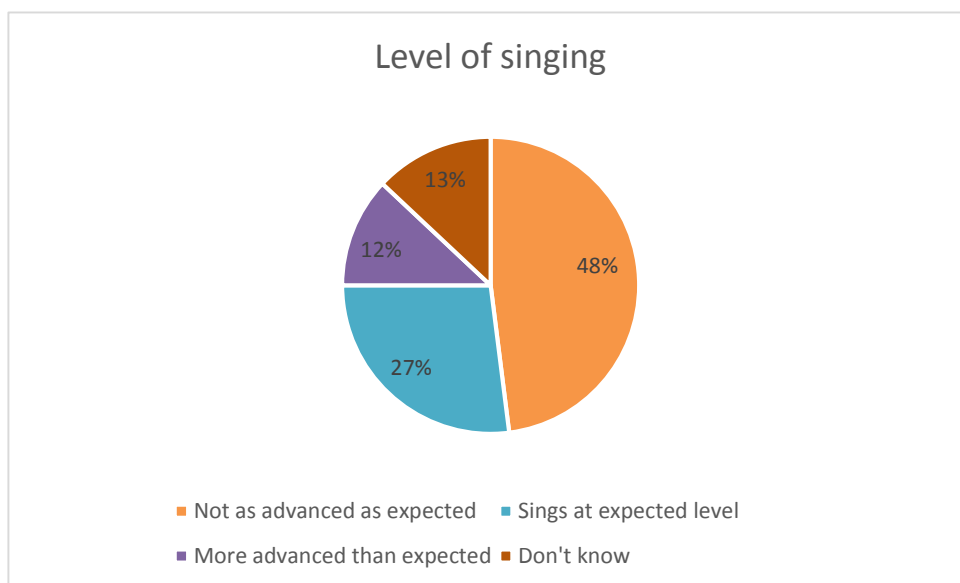


Figure 4.7 Level of singing n=295

5.3.8 *Question 8: Absolute pitch*

5.3.8.1 Concerning absolute pitch, 30% of respondents reported that they did not know whether their child had absolute pitch, 20% of respondents said that their children did possess absolute pitch, and 50% of respondents indicated that their children did not have absolute pitch.

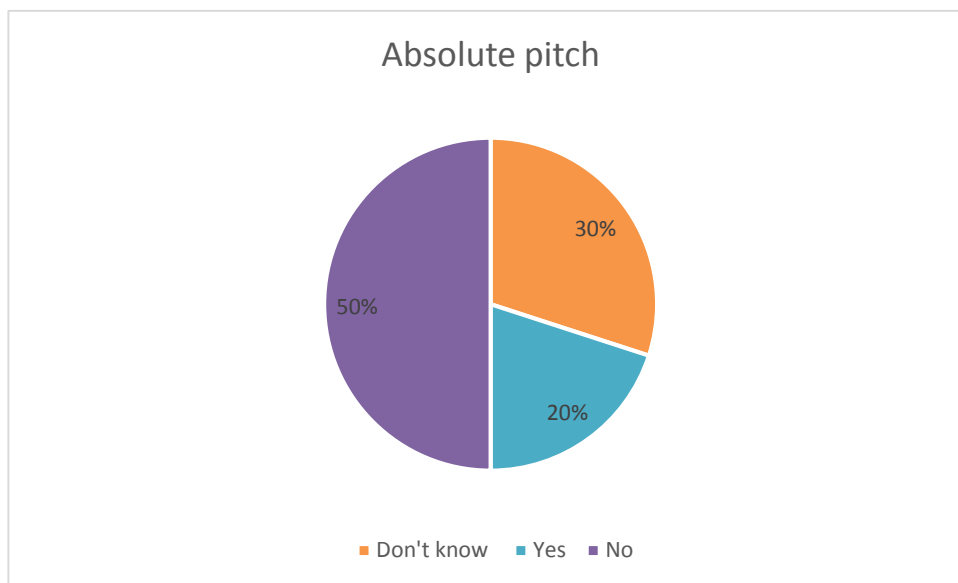


Figure 4.8 Absolute pitch n=303

5.3.9 *Question 9: Singing without words*

5.3.9.1 With regard to children's singing without words, it was reported that 13% of children sang without ever using words, 53% of children sang sometimes using words and 34% of children always use words when singing.

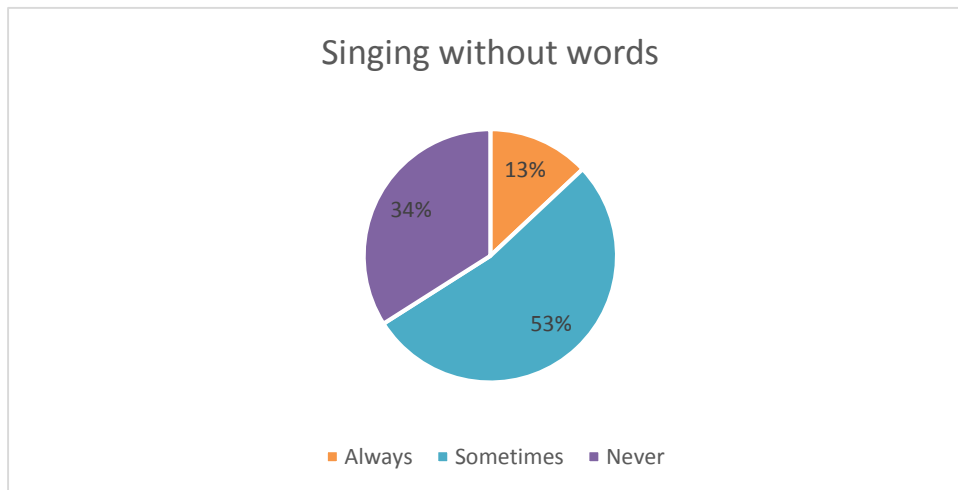


Figure 4.9 Singing without words n=305

5.3.10 *Question 10: Words learnt from song being used in real life situations*

5.3.10.1 Concerning words learnt from songs being used in real-life situations, it was

reported that 35% of children use words learnt from songs in real life while 65% of children do not. This finding suggests that, with regard to observation 1, ‘Can words children with ASC learn from songs cross over into everyday activities?, for just over a third of children with autism who were described in the survey, words learnt from songs are applied to other, non-musical situations.

5.3.10.2 Other factors that may influence the extent to which words learnt from songs cross over into real life situations, and how this may in turn affect the relationship between music and language, are discussed below.

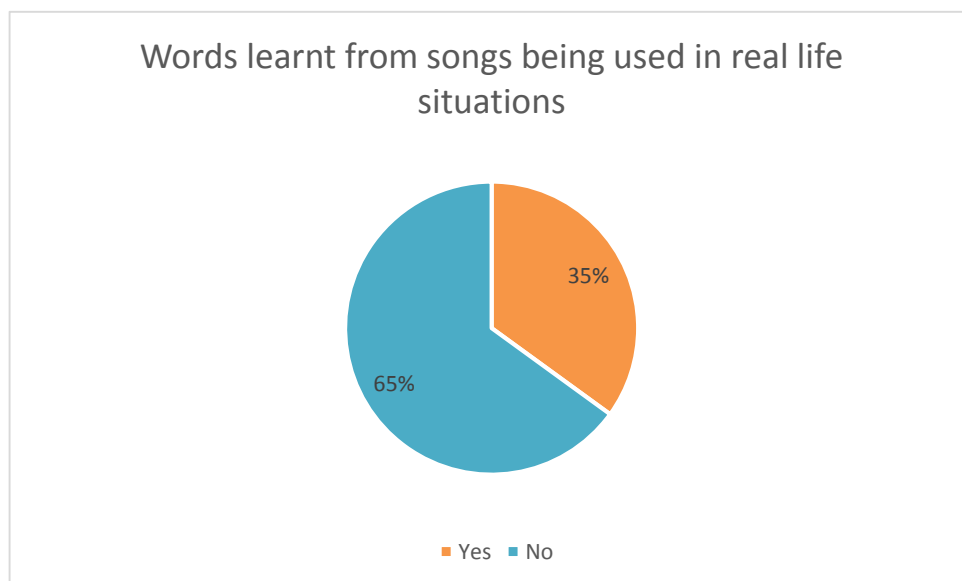


Figure 4.10 Words learnt from song being used in real life situations
n=303

5.3.11 *Question 11: Exposure to music to understand language*

5.3.11.1 It was reported that 62% of respondents exposed their children to music to help understand language, while 38% of respondents did not. The extent to which children are exposed to music to improve linguistic understanding is discussed below.

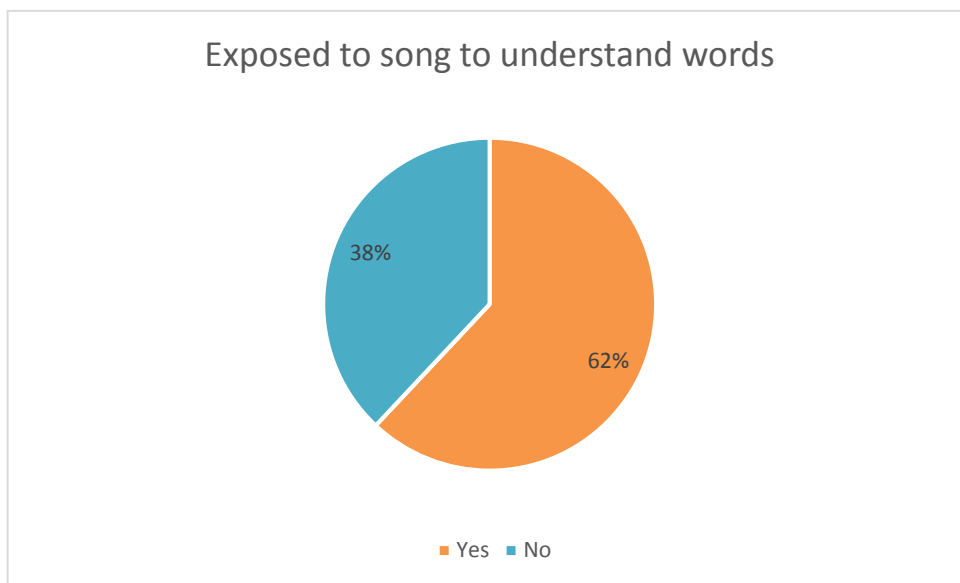


Figure 4.11 Exposed to song to understand words n=313

5.3.12 *Question 12: Singing to express emotion*

5.3.12.1 It was reported that 20% of children sing to express emotion and that 80% of children do not.

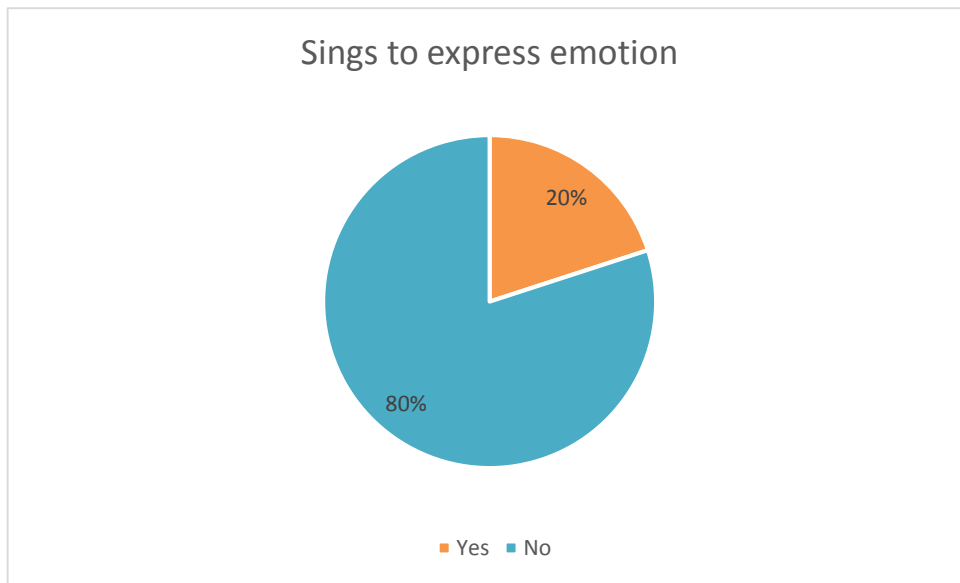


Figure 4.12 Sings to express emotion n=305

5.3.13 *Question 13: Music helping Relationships*

5.3.13.1 With regard to music helping relationships, it was reported that 6% of respondents did not know the extent to which music helps relationships for their child on the autism spectrum. 10% of respondents said that music did not help to enhance relationships at all, and a further 18% reported that music helped enhance relationships 'very little'. Music helped enhance relationships 'somewhat' for 34% of respondents, 'a lot' for 19% of respondents, and 'very much so' for 12% of the respondents.

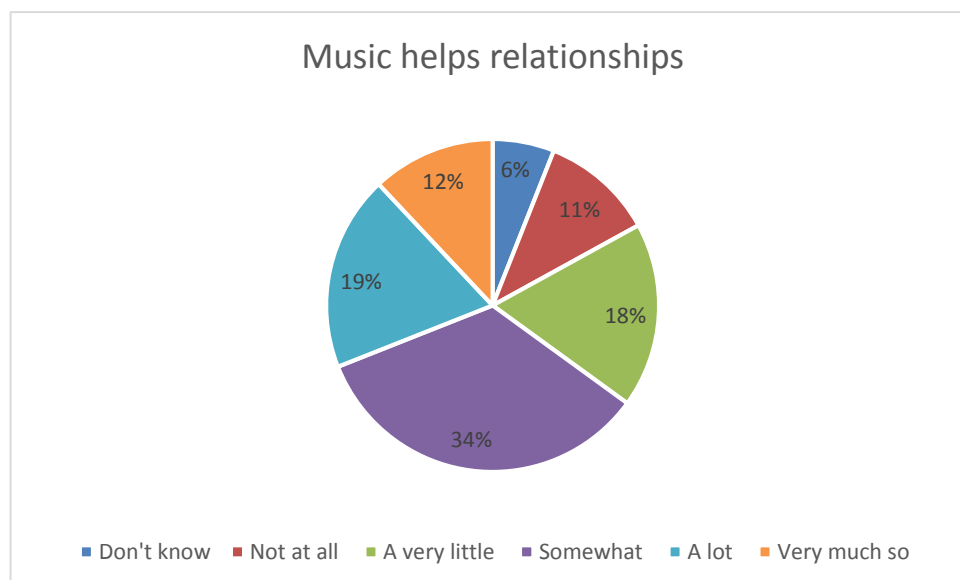


Figure 4.13 Music helps relationships n=316

5.3.14 Preliminary discussion of descriptive findings

This section has presented responses to individual questions. The main findings from this preliminary analysis, according to parents and teachers, are as follows:

- As one would expect, receptive linguistic ability was reported to be superior to expressive linguistic ability
- Around three quarters of the children with ASC were reported to sing

- Over a third of the children with ASC were said to use words learnt from songs in real life situations
- Around two thirds of parents and teachers were said to use songs to help children understand words
- Around two thirds of the respondents reported that music enhanced relationships for children with ASC.

5.4 Analysis of how different variables interact

In this section a series of cross tabulations are carried out between the different variables to observe how they interact – that is, to seek to ascertain whether there is a relationship between one area of a child’s level of development and another.

5.4.1 Level of speech

5.4.1.1 Level of speech v. words learnt from song being used in real life situations

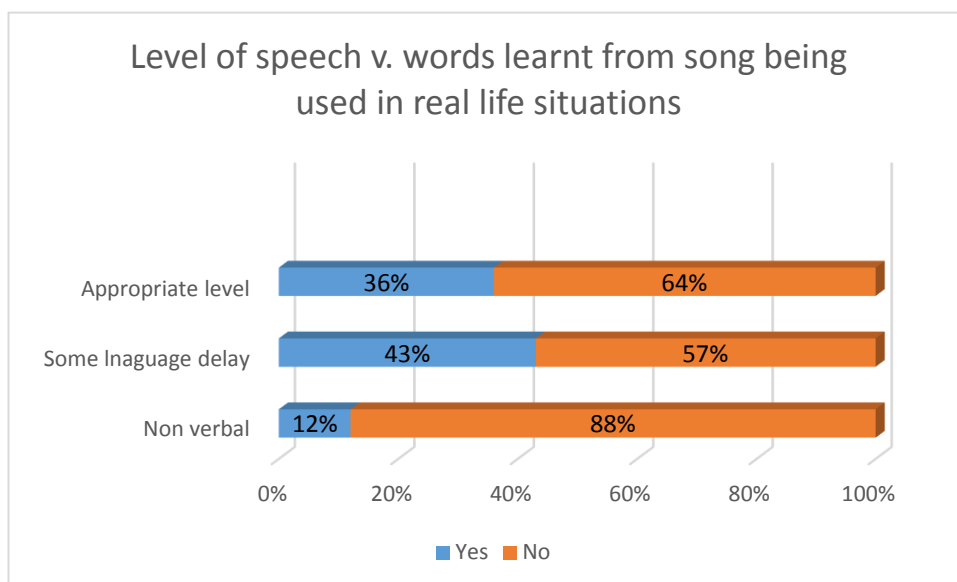


Figure 4.14 Level of speech v. words learnt from song being used in real-life situations

n= 271

5.4.1.2 It was reported that words learnt from songs cross over into everyday activities for 43% of the children with some language delay, compared to just 12% of non-verbal children, and 36% of children who speak at the appropriate level. The fact that 12% of non-verbal children were reported to use words learnt from songs in real-life situations seems something of an anomaly, and this finding is further discussed in the general discussion.

5.4.1.3 Level of speech v. sing or not

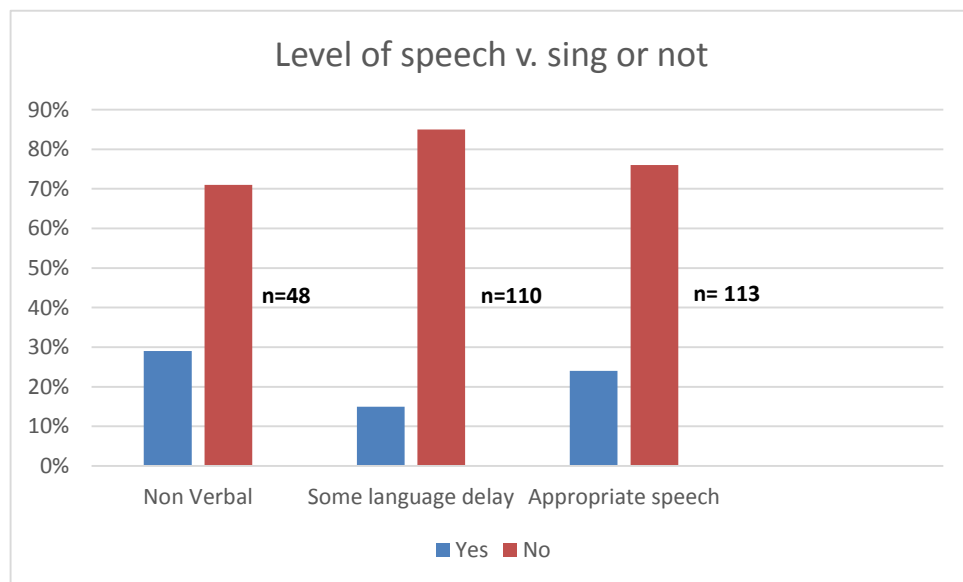


Figure 4.15 Level of speech v. sing or not n=271

5.4.1.4 It is striking that 28% of children who are said to be ‘non-verbal’ sing. This finding has important implications for ASC pedagogy, and for how music might enhance language for some children, and is discussed further in the discussion section below.

5.4.1.5 Level of speech v. level of singing

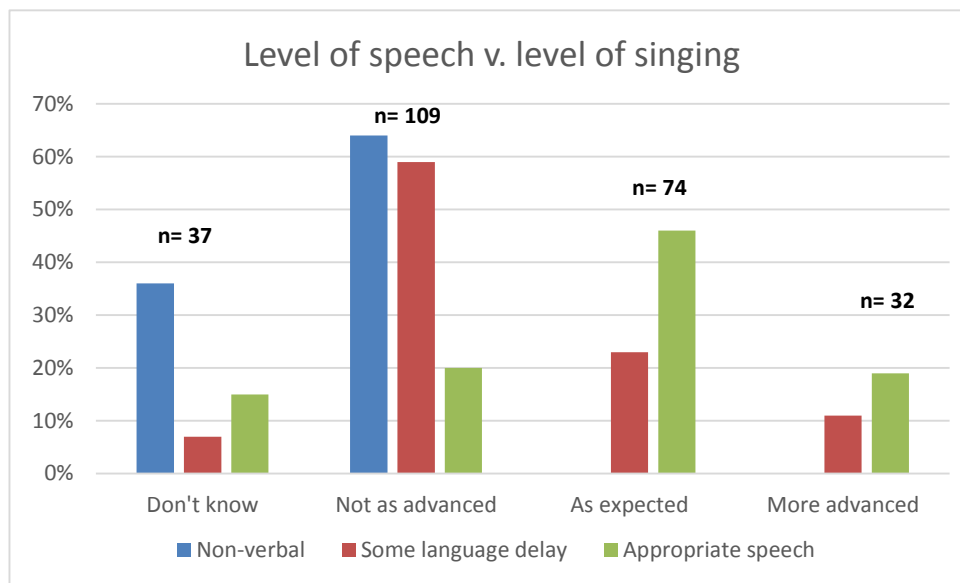


Figure 4.16 Level of speech v. level of singing n=252

It was reported that 11% of children with some language delay sang at a level that was more advanced than expected, while 23% of this cohort sang at the expected level. Thus approximately one third of children with ASC with some language delay (although none who were said to be non-verbal) sing at a level that would be expected, or more advanced than expected.

5.4.1.6 Level of speech v. hours a day singing

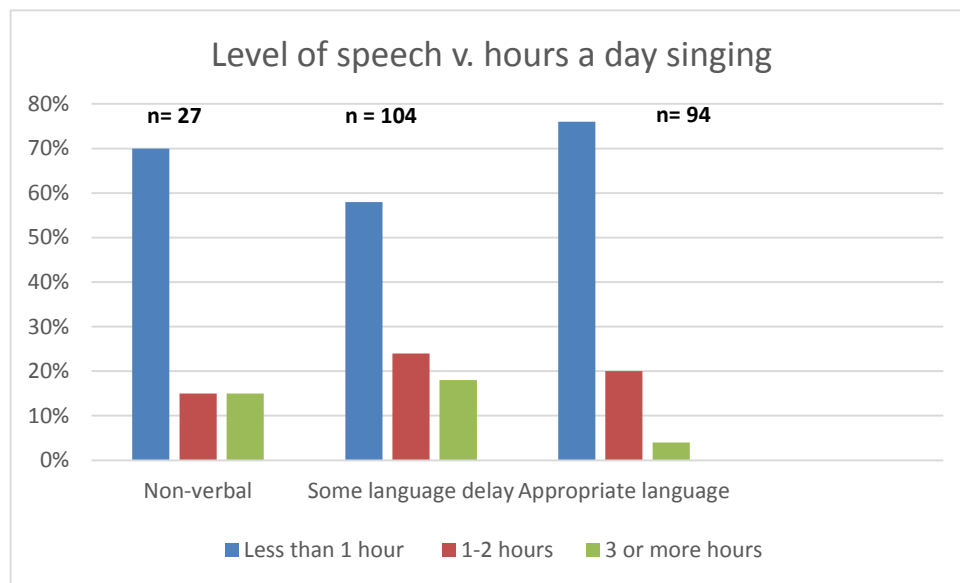


Figure 4.17 Level of speech v. hours a day singing n=225

5.4.1.7 In terms of hours a day spent singing, respondents reported that 15% of children who are non-verbal and 18% of children with some language delay sing for three or more hours a day, yet only 4% of children who speak at an appropriate level for their age sing for this amount of time.

5.4.1.8 Level of speech v. music helps relationships

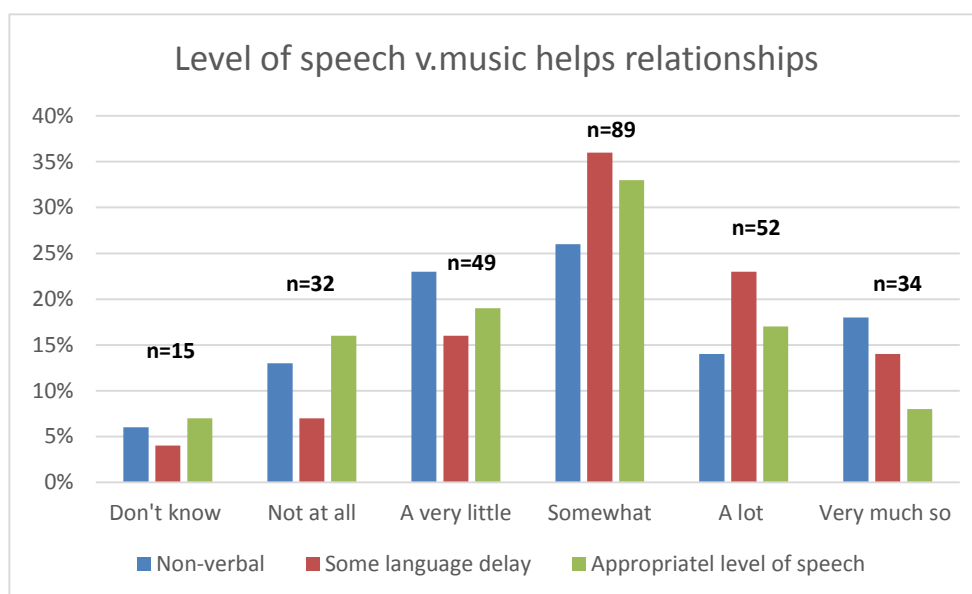


Figure 4.18 Level of speech v. music helps relationships n=271

5.4.1.9 Music was reported to help relationships ‘a lot’ or ‘very much’ for 37% of children who were reported to have some language delay, compared to 32% of children who were non-verbal, and for 25% of children who speak at an appropriate level. Thus, music appears to be most beneficial for children within a certain range of linguistic ability (i.e. more advanced than non-verbal but less advanced than the age appropriate level).

5.4.2 Hours a day singing

5.4.2.1 Hours a day singing v. words crossing over into real life

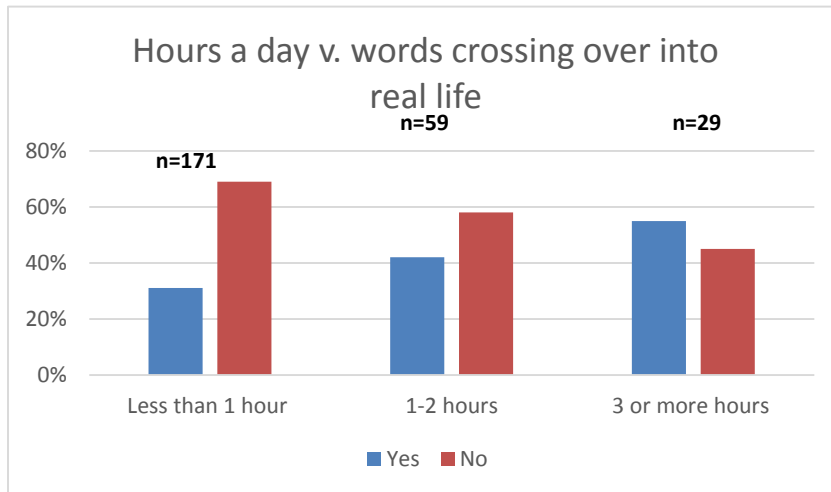


Figure 4.19 Hours a day singing v. words crossing over into real life

n=219

5.4.2.2 As regards the observation, ‘Can words learnt through song cross over into real world situations?’, the results showed that only 31% of children who sing for less than one hour a day used words from songs in real life, as opposed to 42% of children who sing for one to two hours a day, and 55% of children who sing for three or more hours a day. This would suggest that the greater the extent to which a child sings on a daily basis, the more likely it is that words learnt from song will cross over into real-life situations.

5.4.2.3 Hours a day singing – music helps relationships

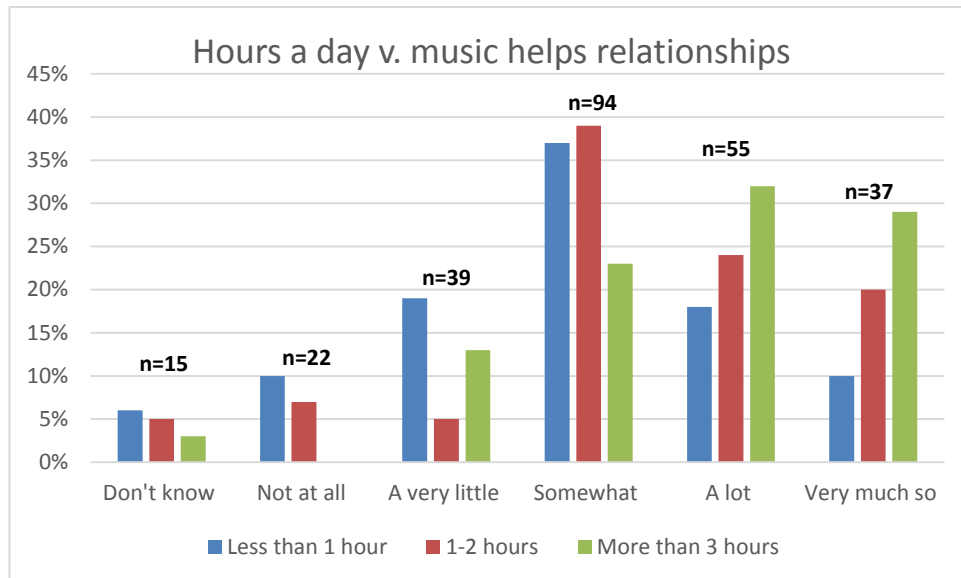


Figure 4.20 Hours a day singing v. music helps relationships n=262

5.4.2.4 Music is reported to help relationships ‘a lot’ or ‘very much’ for 28% of children who sing for less than one hour and 61% of children who sing for more than three hours a day. Conversely, music was reported not to have helped develop relationships, or to have helped them ‘very little’, for 29% of children who sing for less than one hour, and for 13% of children who sing for three or more hours a day. This seems to suggest that music is more likely to help relationships for children who sing more frequently. We can deduce from this that if children with ASC sing frequently, then singing more frequently must be reinforced by significant others.

5.4.3 Preliminary discussion of how different variables interact

In this section, a series of cross-tabulations have been carried out to gauge how different variables that may impact upon a child's musicality and linguistic abilities interact with each other. The main findings are that within the cohort of children who were described in the survey,

- Over a quarter of children described as non-verbal sing
- Children with some language delay (around nine out of ten) are more likely to sing than non-verbal children or children who speak at an appropriate level for their age
- Music is more likely to enhance relationships for children with some language delay, than for children who are non-verbal, or for children who speak at an age-appropriate level
- Words learnt through songs are more likely to cross over into real-life situations for children with some language delay, compared to children who are non-verbal or children with age-appropriate speech
- Music is more likely to help relationships for children with ASC who sing a lot
- The more advanced level at which a child sings, the more likely it is that words learnt through song will cross over into real-life situations
- Music is more likely to enhance relationships for children who sing at a more advanced level
- Music is more effective in helping relationships for children who use words from songs in real-life situations.

5.5 Differences between the responses from parents, teachers and others

5.5.1 In this section, differences between the responses from parents, teachers and others are discussed with regard to how they perceive the linguistic and musical abilities of their children, as well as the role music plays in their lives and how music affects social and communication skills.

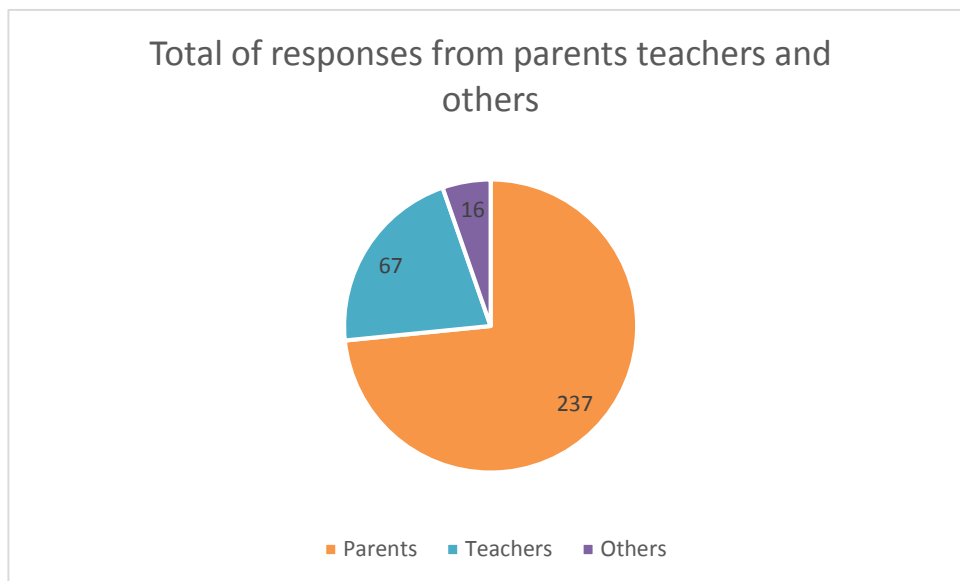


Figure 4.21 Total of responses from parents, teachers and others

n=320

5.5.2 A total of 237 (74%) of all responses were made by parents. Sixty-seven responses were made by teachers (21%), and a further 16 responses (5%) came from other family members (siblings or grandparents), carers and therapists. Differences of opinion between teachers and parents with regard to linguistic and musical abilities of the children are discussed below.

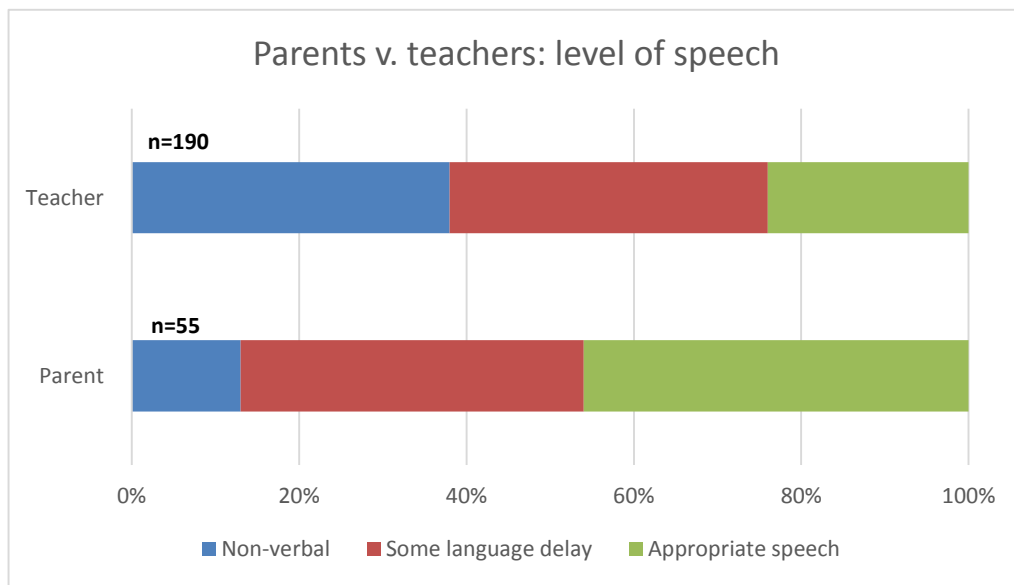


Figure 4.22 Parent v. teachers: level of speech n=245

5.5.3 In total, 46% parents stated that their children speak at an appropriate level, as opposed to just 25% of teachers. Conversely, 38% of teachers reported that their children were non-verbal as opposed to just 13% of parents. This suggests that parents are more positive than teachers with regard to their children's speech capability. This may be because parents have a deeper insight into the idiosyncratic ways in which their children communicate.

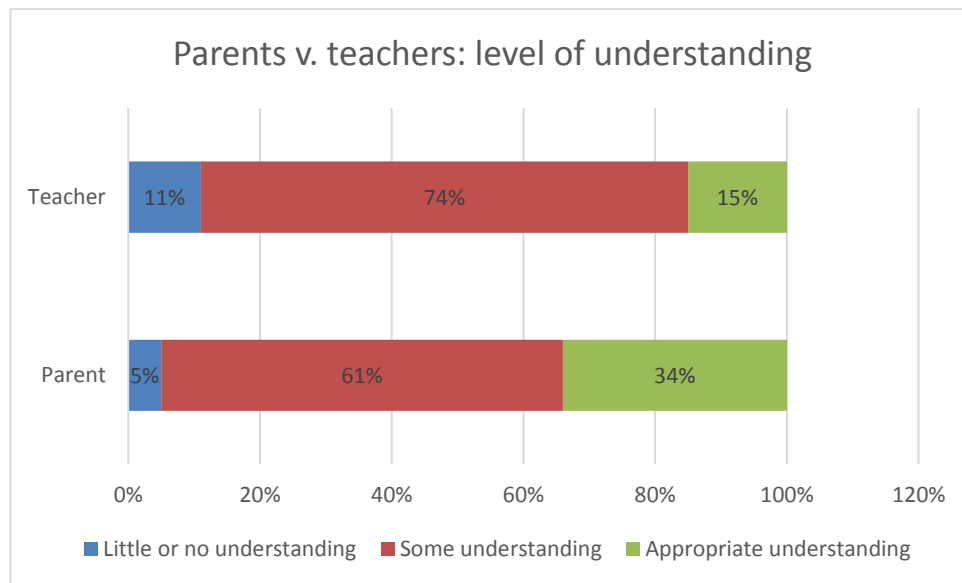


Figure 4.23 Parents v teachers: level of understanding n=285

5.5.4 With regard to understanding language, 34% of parents stated that their children understand language at an appropriate level, compared to just 15% of teachers. These findings suggest that parents are more positive than teachers with regard to their children’s receptive linguistic capabilities. Again this may be because parents better understand the idiosyncratic ways in which their children communicate.

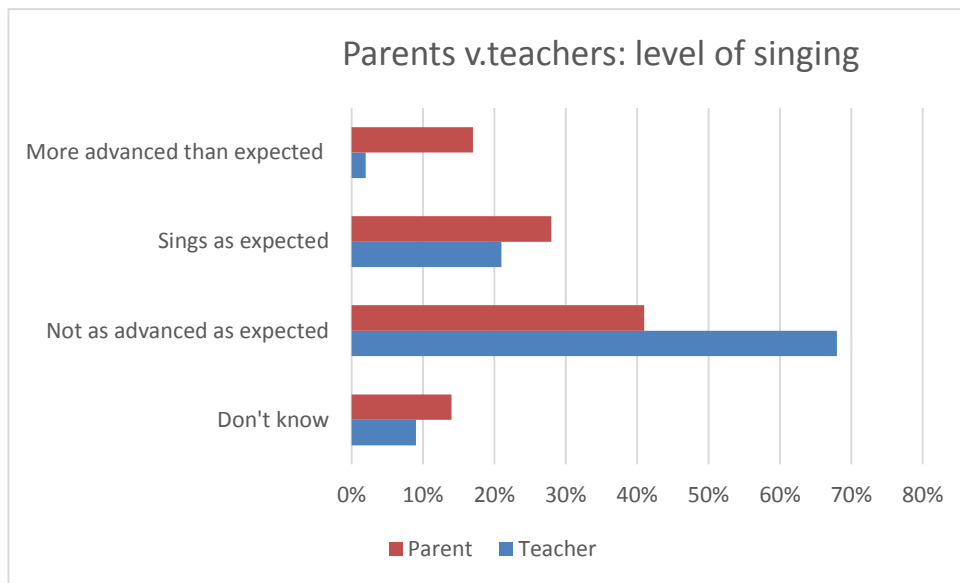


Figure 4.24 Parents v. teachers: level of singing n=277

5.5.5 Parents reported that 17% of children were more advanced than expected with regard to the level of their singing, as opposed to just 2% of teachers. Furthermore, just 42% of parents believed that the level of their children's singing ability was not as advanced as expected, compared to 67% of teachers. From these findings, it would appear that parents are more positive than teachers with regard to the level of their children's singing abilities.

5.5.6 Preliminary discussion on differences between teachers parents and others

There were significant differences in the ways in which parents and teachers rated the abilities of children with ASC with regard to music and language, as well as differences in opinions on the role that music may play in the lives of these children. The main differences were as follows:

- Parents were more positive than teachers with regard to children's level of speech.
- Parents were more positive than teachers with regard to children's understanding of language.
- Parents were more positive than teachers with regard to children's level of singing.

5.6 Discussion

- 5.6.1 In this section, implications of the findings from the questionnaire are discussed with reference to questions on an individual basis (the descriptive statistical findings), as well as with regard to the way in which the different variables interact with one another.
- 5.6.2 With regard to the level of children's understanding of language, or children's level of receptive language skills, it was reported that just 28% of children understood language at a level that would be considered appropriate for their age (see Figure 4.4). This finding accords with the views of Eyler and Pearce (2011) who proposed that failure to develop normal language comprehension is an early warning sign of autism, although the neural mechanisms underlying this signature deficit are unknown. However such a comparison can only be made with some caution as the research carried out by Eyler and Pearce focused on pre-school children on the autism spectrum, whereas respondents in this questionnaire were not subject to age restrictions.
- 5.6.3 The finding that around three quarters of children on the autism spectrum sing reinforced the finding from the semi-structured interviews, that singing is a popular activity for children with ASC (see Figure 4.5). This finding was particularly useful in helping to design the practical phase of the study, where a decision was made to ascertain the effects of singing on verbal recall as opposed to other musical activities, (i.e. listening to a piece of music, or playing an instrument).

- 5.6.4 With regard to level of speech, respondents reported that children with some language delay (as opposed to non-verbal children, or children with age appropriate speech) were the most likely to sing. This finding is in accordance with Lim, (2012: p.189), who provided evidence to suggest that speech training was as effective as music training for improving speech production in ‘high-functioning’ children with ASD. However for ‘low-functioning’ children with autism, participants showed greater improvement in speech after the music training (see 3.5.2.11).
- 5.6.5 The finding that 20% of participants possess absolute pitch seems high in relation to findings of the literature. In the general population, absolute pitch is a rare phenomenon exhibited by only one in 10,000 individuals (Profita and Bidder, 1988; Takeuchi and Hulse, 1993). A study carried out by DePape, Hall, Tillmann and Trainor (2012) found that three out of 27 children with ASC (just over 11%) possessed absolute pitch.
- 5.6.6 This finding that 20% of children with ASC have absolute pitch may therefore suggest that not all participants fully understood the question. An explanation of absolute pitch was included in the questionnaire (describing absolute pitch as the ability to either name specific notes or to always sing in the same key), although parents may still not have fully understood what it means to have absolute pitch (see Figure 4.8).
- 5.6.7 Participants in the interviews reported that words that children with ASC learnt from songs could be useful in non-musical contexts. Responses to the questionnaire indicated that over a third of children with ASC use words learnt from song in real

life (see Figure 4.10). Thus the first observation, that words children with ASC learn from songs cross over into everyday activities, would appear to be the case for some, but not all children with ASC. Other variables that may impact on whether or not words learnt through songs can be used in a non-musical context for children with ASC are discussed below. The fact that around two thirds of respondents reported that they used songs to help children understand words, would also suggest that exposure to song may enhance both receptive and expressive skills for some (but not all) children with ASC (see Figure 4.11).

5.6.8 With regard to the second observation, that involvement in musical activities can enhance social relationships for children with ASC, around two thirds of the respondents reported that music can enhance relations for children on the autism spectrum (See Figure 4.13). Recent research carried out by DePape, Hall, Tillmann and Trainor (2012) showed that context involving human social interaction are much more effective than an equal amount of exposure in a non-interactive context for phonemic learning to occur.

5.6.9 Thus, early social deficits in ASC might also be hypothesised to lead to poorer receptive language skills. If interaction with others through music can go some way to countering social deficits in ASC, then arguably, involvement in musical activities with others might indirectly augment speech and communication skills for children with ASC.

Having discussed the implications of the findings with regard to questions on an individual basis, we now turn to how variables interacted with one another.

5.6.10 Respondents reported that over a quarter of children described as non-verbal sing (see Figure 4.15). The fact that children who are non-verbal can sing supports the views of Ockelford (2008: p.139) who asserts that,

‘since there are neurological differences in the way that music and speech are processed following the early stages of development, children and young people who are unable to speak, or who find verbalising difficult, may none the less be able to communicate through *singing* words and phrases, or at least intoning them within a rhythmic structure.’

5.6.11 Furthermore, comparing musical development and the development of communication, he states that ‘production of the simplest music structures (stemming from the repetition of sounds) precedes the use of formal linguistic structures by some margin’ (Ockelford 2008: p.131). The finding that over a quarter of children with ASC adjudged to be non-verbal nevertheless sing would accord with such a view.

5.6.12 Another interesting finding, with regard to how the level of a child’s singing impacts upon the likelihood of a child singing or not, is that children with some language delay (85%) are more likely to sing than non-verbal children (71%) or children who speak at an appropriate level (76%). This finding suggests that, as the level of language becomes more sophisticated, the impact music has on enhancing language will decrease. These findings accord with Lim (2010: p.87), who showed in her study that the effect of music training had more of an impact on children with low-functioning autism than on children with high-functioning autism. Employing an applied behavioural analysis technique, she developed a technique she labelled

‘Developmental speech and language training through music’ which addresses strategies recognising the importance of music for children’s learning by selecting and adapting musical material which children find intrinsically motivating.

- 5.6.13 In a similar vein, with regard to the second observation, ‘Does music enhance relationships for children with ASC?’, results from the questionnaire suggest that music can enhance relationships for some children with ASC, and that this effect is more pronounced for children with some language delay, as opposed to non-verbal children or children with age-appropriate speech (see 3.5.2.11).
- 5.6.14 The finding that some children with ASC appear to sing more readily than they speak, supports the views of Serafine, Crowder and Repp (1984), who proposed that the memory representation for songs consists of integrated components (melody and text). I would argue that if some children can sing but not speak, this could imply that for these children, both words and melody of song are integrated in memory. If the words and music from song are processed independently, it would stand to reason that, if a child were able to sing, he or she might also use words in the absence of a melody. If he or she were able to simultaneously use both the words and the melody, and they were two separate entities, the child might use either one of these entities in the absence of the other (see 3.5.4.6). This line of thought is further deliberated upon in the general discussion chapter.
- 5.6.15 In terms of hours a day spent singing, respondents reported that the number of children who are either non-verbal, or have some language delay and sing for three or more hours a day is greater than the number of children who speak at an

appropriate level for their age and sing for three or more hours a day in contrast to children who speak at an appropriate level for their age and sing for three or more hours a day. Thus, respondents reported that children with some language delay are not only more likely to sing but, are also more likely to sing for longer periods of time (See Figure 4.17).

5.7 Conclusion

- 5.7.1 The main purpose of the questionnaire was to inform the practical phase of my research, although it was expected that any findings to emerge would also be of interest in their own right.
- 5.7.2 An important finding to emerge from the questionnaire was that over a quarter of children described as non-verbal sing. This would suggest that some children find it easier to sing than to speak.
- 5.7.3 With regard to singing, it was reported that children with some language delay are more likely to sing than non-verbal children or children who speak at an appropriate level for their age. It was also reported that music is more likely to enhance relationships for children with some language delay.
- 5.7.4 There were significant differences between teachers' and parents' views of the levels of the children's musical and linguistic abilities, and the role that music plays in the lives of children on the autism spectrum, the main difference being that parents were more positive about the level of their children's abilities.

- 5.7.5 With regard to the first research question, ‘Does the co-existence of melody with a string of words make the words easier to learn and reproduce for children with ASC?’, in the view of the respondents, music can enhance speech and language for some, but not all, children on the autism spectrum, and the level of linguistic ability affects the extent to which music may impact on speech and language.
- 5.7.6 As mentioned in the review of literature, there are three possible reasons why non-verbal children may sing more than they speak. According to ‘Arousal Theory’ (Schellenberg, 2005), music impacts positively on language because of the arousing effect music can have on listeners, which subsequently effects receptive and expressive linguistic abilities. Secondly, ‘shared neural resource’ theory proposes that the neural encodings of both music and language share resources, and exposure to music could thus strengthen areas of the brain that are involved in the processing of language. Thirdly, the unique style of processing that some children with ASC employ may explain why some children sing as opposed to speak.
- 5.7.7 With regard to the first observation, that words children with ASC learn from song can cross over into everyday activities, it would appear that words from songs may be useful in non-musical contexts for some children on the autism spectrum, but mostly for children with some language delay. Similarly, with regard to the second observation, that involvement in musical activities can enhance social relationships for children with ASC, it would appear that music has the most impact on enhancing relationships for children with some language delay, as opposed to non-verbal children or children who speak at an age-appropriate level.

- 5.7.8 It is not clear why music may enhance speech for some children with ASC, although three possible reasons have been discussed here. Firstly, since music and language share some neurological resources, exposure to and involvement in music may increase the connectivity and plasticity of neural networks involved in the encoding of language. Secondly, the presence of music, or singing as opposed to speaking, may have an arousing effect within the autonomous nervous system and thus the presence of music enhances speech through an arousal effect. Thirdly, because of the idiosyncratic way in which some children with ASC process stimuli, due to an enhanced level of perceptual processing, they may have an ability to recognise and perceive the different elements embedded within a melody; thus, it is through a process of association of words with music that music can have an augmentative effect on language for some children with ASC.
- 5.7.9 Finally, it was envisaged that the questionnaire would complement as well as inform the comparative intervention in the third phase of this research. With regard to the design of the comparative intervention, the questionnaire was of value in that participants at the level of one- or two-word sentences were recruited, as the findings here suggest that it is for this cohort that music will have the greatest impact on language.

Chapter 6: Comparative Intervention

6.1 Introduction

6.1.1 In this chapter, methodological issues pertaining to the empirical study are considered, and results obtained from both the learning phase and the recall phase of the practical sessions are presented and analysed. Results are contextualised within research findings from the field, how responses relate to the research questions in this study, and how responses support or contrast with findings from the questionnaire.

6.1.2 To recap, the hypotheses for this study were that:

- 1) the co-existence of music and words may facilitate language and music learning and utilisation for children with ASC; and
- 2) this effect will be more marked for children with ASC than those developing neurotypically.

The research questions relating to the practical sessions were as follows:

6.1.3 Research Question 1

Does the co-existence of melody with a string of words make the words easier to learn and reproduce for children with ASC?

Research Question 2

Does the co-existence of a string of words with melody make the melody easier to learn and reproduce for children with ASC?

Research Question 3

Does the co-existence of melody with a string of words make the melody easier to learn and reproduce for neurotypically developing children?

Research Question 4

Does the co-existence of a string of words with a melody make the melody easier to learn and reproduce for neurotypically developing children?

6.2 Methodology

6.2.1 Ethics

6.2.1.1 There are certain ethical issues involved in carrying out research of this nature, especially with regard to working with young children and young children with autistic spectrum condition who have difficulties with language and may not have enough understanding to know what is happening to them.

6.2.1.2 Consequently, the researcher asked the teachers and parents at the schools and organisations involved to explain to the participants the nature of this project, as far as possible. According to the individual needs of each student, additional strategies were used by teachers and teaching assistants such as the Picture Exchange Communication System (PECS), www.pecs.com and Makaton, www.makaton.org to help participants become more aware of what they were going to be asked to do. Individual professionals who work with the children were asked to note and inform the researcher if the children were thought to have a negative reaction to engagement in the activities. In addition, parents were provided with written information

regarding the aims of the study and the data collection process. They were asked to give full consent for the participation of their children in the research and were informed of their right to withdraw the child at any time.

6.2.1.3 The sessions were video-recorded, and parents were informed that the videos would be viewed by both the researcher and the supervisors. As a result, children's faces were clearly visible and therefore identifiable to the researcher and to the supervisors of the study. Because of this, the video will not be used in any presentations or conferences in which this study might be included, and the video will be destroyed after completion of the study. All participants and their primary carers had the right to withhold permission for their child to be filmed. All results were reported honestly and precisely. Publication of results complied with the Data Protection Act, 1998, with regard to storage of electronic information and asking respondents to opt in as opposed to opting out, and all participants' information has been carefully protected. No names were attached to either the video-recordings or the interviews. Video footage was transferred to a password-protected PC and was only accessible to the researcher.

6.2.1.4 All data were saved in two different databases. Documents containing personal information and contact details of participants and any personal data were stored in a separate database that was accessible only to the researcher on a password-protected PC. A reference number was used in the accessible database to further protect the identity of the participants.

- 6.2.1.5 Hard copies of recorded videos were kept in a locked drawer in the researcher's office, and the researcher was the only holder of the key. Extra care was taken when transporting data between schools and organisations, the University and the researcher's home, in that data were concealed in a locked briefcase to ensure that the contents were not accessible to any third party.
- 6.2.1.6 It was agreed before the study was carried out that if a child became distressed at any stage the researcher would stop the session and seek to reassure the child. If distress was not reduced the researcher would ask the teacher, carer, or Learning Support Assistant to withdraw the child either from the activity, the session or from the whole procedure. However, in the event, no child became distressed during the empirical study, and at no time was the researcher ever alone with a child. To counter the possibility of a child becoming distressed, at all times the researcher strove to design activities within the empirical phase in a way that meant they were enjoyable.
- 6.2.1.7 With regard to both the autistic and the neurotypical children, teachers were consulted to ascertain which pupils would be suitable to participate in the music activity sessions, ensuring no children were involved who could find participation in these activities stressful in any way. Such consultation took place before the commencement of any of the sessions. As the children on the autism spectrum were not necessarily able to give informed consent before sessions took place, a discussion was held with the teachers with regard to looking out for any signs of distress or unusual behaviour displayed by any of the children involved.

6.2.1.8 It is hoped that the teachers and parents involved in this study will eventually benefit from their children taking part through an increased awareness of the potential power of music to enhance their children's abilities to communicate more effectively.

6.2.1.9 At all times the researcher strove to use language at an appropriate level, and in the case of participants with delayed communication skills the researcher asked for specific advice from teachers or carers in terms of the best way to communicate, so as to cause the minimum amount of stress for that particular participant. Moreover, there was always at least one other person present (parent, carer or significant other) at all stages of this study, as the participants involved were under the age of 18.

6.2.2 **Participants**

6.2.2.1 The empirical study involved two groups:

- ASC group (N=24)
- Neurotypical comparison group (N=32)

ASC group

6.2.2.2 The ASC group initially consisted of 60 children. From previous research, I was aware that there would be a high rate of attrition, although this rate was more challenging than expected, in that only 24 participants in the autism group completed the study, N=24, 3 to 16 years, M= 8.17, SD= 3.3

Reasons for children dropping out included:

- illness
- participating in other activities
- behavioural issues on the day
- change of school

6.2.2.3 The sample was drawn from three London special schools in the London Borough of Hammersmith and Fulham:

- Primary School A
- Secondary School A
- Primary School B

6.2.2.4 The extent to which the sample was representative of the population of individuals on the autistic spectrum was hard to gauge, as the autism spectrum as a whole is ill-defined (Frith 2007: p.13), although some indications are known such as the prevalence of boys over girls (4:1) (Baron-Cohen 2008: p.34), which was characteristic of my sample.

6.2.2.5 The schools were primarily chosen as they had a reputation for being active in terms of participating in research relating to children with ASC with the University of Roehampton. Secondly, there was a large enough sample of children with ASC within the three schools to carry out an effective study. The children at one Primary School were attending an inclusive unit within mainstream provision, and another group of children were selected from the primary division and the secondary division of a Special School. Head teachers were requested to select children for the

study who were functioning at the one- or two-word level. In the event, some children participated who had more advanced linguistic abilities.

6.2.2.6 Age range of pupils with ASC

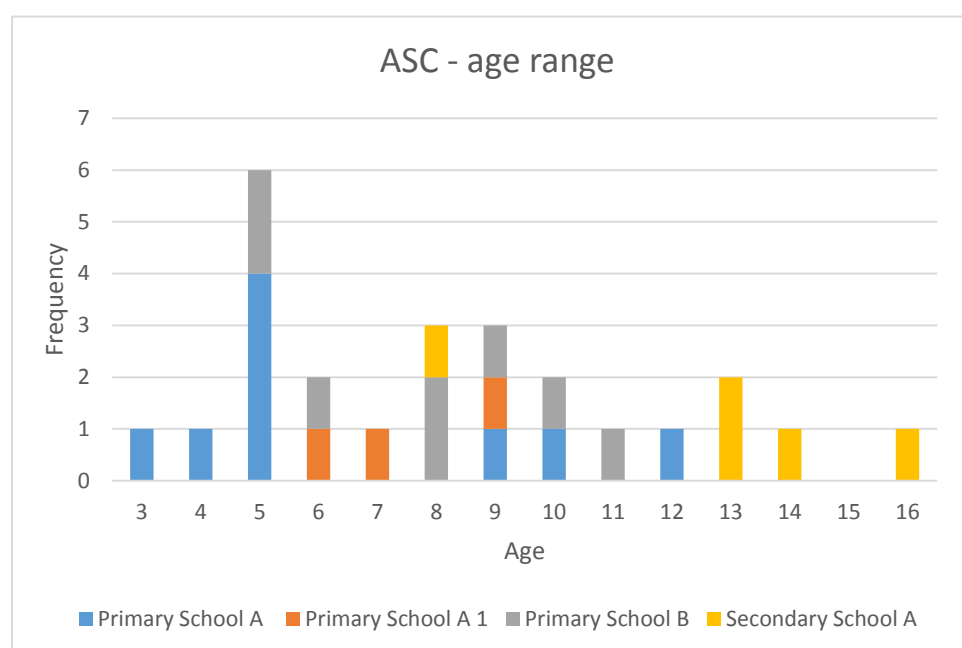


Figure 6.1 Age range of pupils with ASC N=24

Comparison group

6.2.2.7 The comparison group comprised ‘neurotypical’ children. N=32, 5 to 11 years, M=8.25, SD = 2.16. Hence they were matched with the ASC group in terms of mean age. All children involved in this study attended one of two primary schools in Cornwall:

- Primary School A
- Primary School B

6.2.2.8 These two schools were chosen on account of their proximity to the researcher's home. Although the ASC group came from an ethnically diverse urban community and the comparison group came from mono-cultural rural communities, all the children used English as a first language, and thus it is hoped that the diversity of backgrounds from which the children came did not unduly affect the results.

6.2.2.9 Age range of Comparison group

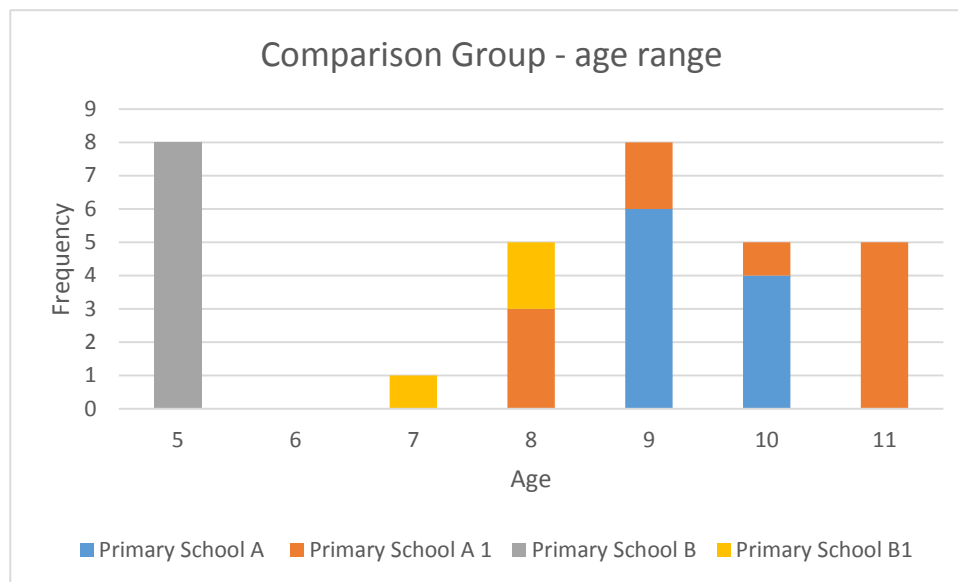


Figure 6.2 Age range of comparison group N=32

6.2.2.10 The number of children with ASC at each school was as follows:

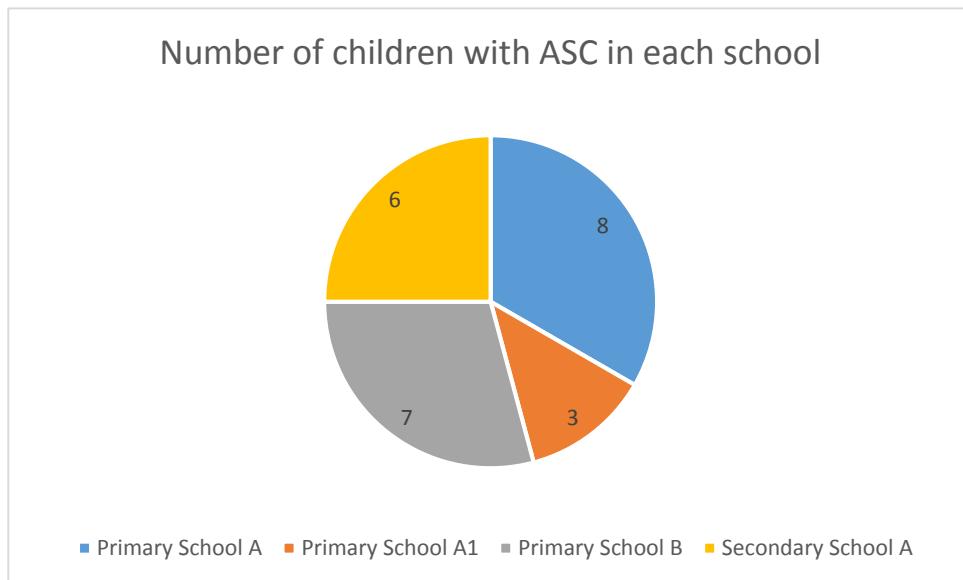


Figure 6.3 Number of children with ASC in each school N=24

‘Primary School A’ refers to children who were seen on a Monday, and ‘Primary School A1’ refers to children at the same school who were seen on a Tuesday.

6.2.2.11 The number of neurotypical children comprising the comparison group at each school was as follows:

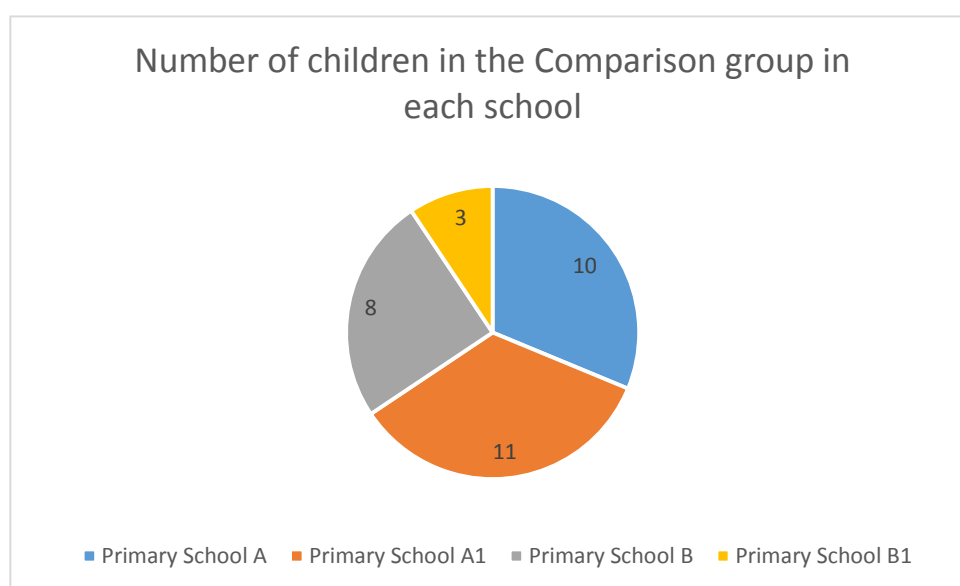


Figure 6.4 Number of children in the comparison group in each school N=24

‘Primary School A’ refers to children seen in a morning session, and ‘Primary School A1’ refers to children at the same school who were seen in the afternoon. In a similar way, children from ‘Primary School B’ were seen in the mornings and children from ‘Primary School B1’ were attending the same school and seen in the afternoon.


6.2.2.12 Pilot sessions for the practical sessions were carried out between November and December, 2011. The participants consisted of four neurotypical children (three males and one female) aged between five and nine years, all attending primary schools near to where the researcher lives in Cornwall. Only neurotypical children were included in the pilot study, as the purpose was to run through the experimental procedure. There were no issues with regard to any of the neurotypical children understanding the instructions given to them or understanding the tracks.

6.2.3 Materials

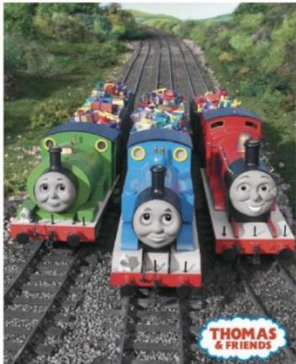
- 6.2.3.1 Three children's songs, using the content of a popular children's television series, 'Thomas the Tank Engine,' were especially composed for this study by Adam Ockelford, Professor of Music at the University of Roehampton. This content was chosen because the head teacher at both the Primary and Secondary division of one of the Special Schools had spoken of how this series was very popular with the children. The pieces had to be specially composed to avoid potential issues of familiarity. The words and music from each piece were matched as far as possible for complexity and memorability, structure, rhythm and pitch range.
- 6.2.3.2 With regard to the melody, all three pieces use the first five notes of the major scale, and the intervals between notes are limited to a perfect 4th. In terms of rhythm, there is no syncopation. All pieces were recorded at 120 bpm (beats per minute). With regard to language, all pieces use the present tense, and use simple words embedded within short phrases that refer to concrete things (as opposed to using metaphor, for example).
- 6.2.3.3 Each piece was matched to an A3 laminated poster depicting different scenes from the 'Thomas the Tank Engine' children's television series, relating to lyrics from the individual pieces, as shown below. The poster was included to act as a prompt for the recall condition to avoid the need to use material (words or music) from the song, which would subsequently have affected measurements of both verbal and melodic recall. Furthermore, past research has provided evidence to suggest that

visual prompts can facilitate learning for children with ASC (Dettner and Simson, 2000).

6.2.3.4



I can tell you what I can see. I can see the engines, one, two, three.



THOMAS & FRIENDS

Figure 6.5 Piece 1



Sing a song for Thomas, this is how it goes. Can you see his wheels and can you see his nose?

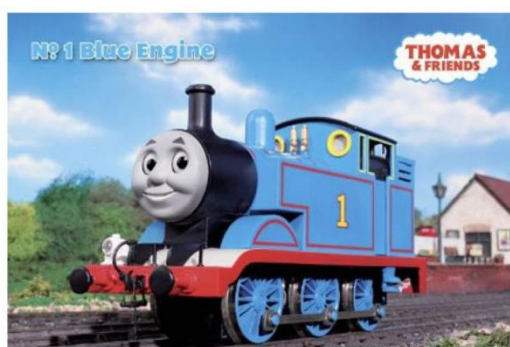


Figure 6.6 Piece 2



Here are the engines, all in a row. They are all smiling and ready to go.

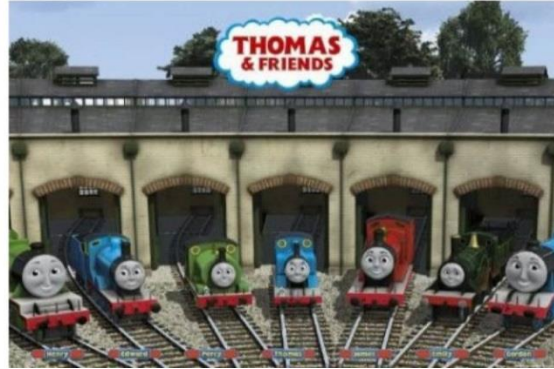


Figure 6.7 Piece 3

6.2.3.5 The three pieces, in each of three conditions (words-and-music, music-alone, words-alone) were recorded using the music programme Cubase in a home studio setting. The singer was a female, aged nine, with no formal vocal tuition, but who could sing in tune and in time. The recordings were made using a click track (which was subsequently muted), to keep a consistent tempo within and between the three songs.

6.2.4 Procedure

6.2.4.1 Participants involved in the study took part in six sessions, which were carried out once a week over a period of six weeks. All sessions used one of the three pieces mentioned above. Pieces were presented in three different ways. These were:

- A) In the form of a song, with words and music.
- B) In the form of lyrics, narrated as prose, at the same beats per minute as the song but in the absence of melody.
- C) In the form of a melody sung on the syllable 'lah' (that is without lyrics) at the same tempo as the song.

6.2.4.2 In week one, participants were asked to learn one of three pieces in one of the three conditions mentioned above. In week two, they were asked to recall whatever they could of the stimulus presented in week one. This protocol was repeated in weeks three and four, and five and six.

6.2.4.3 To mitigate order effects, children in each group were split into four subgroups. The original intention was to counter order effects by having six equal groups participate in the six different running orders that were possible, whereby:

A = words-and-music condition

B = words-only condition

C = music-only condition

Week	1 Learning	2 Recall	3 Learning	4 Recall	5 Learning	6 Recall
Group 1	A	A	B	B	C	C
Group 2	A	A	C	C	B	B
Group 3	B	B	A	A	C	C
Group 4	B	B	C	C	A	A
Group 5	C	C	A	A	B	B
Group 6	C	C	B	B	A	A

Table 6.1 Possible running order of pieces

6.2.4.4 As stated above, the original intention was to recruit 90 children with ASC.

However in the event it only proved possible to recruit 60 (which through attrition was reduced to 24); thus, the full Latin square design was not possible and six sequentially discrete dyads were used:

- Words followed by music
- Words followed by music and words
- Music followed by words
- Music followed by words and music
- Words and music followed by words
- Words and music followed by music

(As it happened, no order effect was apparent in the results, as will become apparent.)

6.2.4.5 Each subgroup underwent the different conditions (i.e. whether the piece was presented in the context of words-and-music, words-only or music-only) in a different order. Furthermore, the three separate pieces were presented in a different order for each one of the four subgroups. The order of events for each one of the subgroups within both the experimental and the comparison group was as follows:

Autism Group

6.2.4.6

Week	Activity Monday group (group A)	Piece	Activity Tuesday group (group A1)	Piece
1	Words-Music	1	Music-only	3
2	Test	1	Test	3
3	Music-only	2	Words-Music	2
4	Test	2	Test	2
5	Words-only	3	Words-only	1
6	Test	3	Test	1

Table 6.2 Order of events, Primary School A and Primary School A1

6.2.4.7

Week	Activity	Piece
1	Words-only	2
2	Test	2
3	Words-Music	1
4	Test	1
5	Music-only	3
6	Test	3

Table 6.3 Order of events, Primary School B

6.2.4.8

Week	Activity	Piece
1	Words-Music	1
2	Test	1
3	Words-only	3
4	Test	3
5	Music-only	2
6	Test	2

Table 6.4 Order of events, Secondary School A

Comparison Group

6.2.4.9

Week	Activity (Group A)	Piece	Activity (Group A1)	Piece
1	Words-only	2	Words-only	2
2	Test	2	Test	2
3	Music-only	3	Words-Music	1
4	Test	3	Test	1
5	Words-Music	1	Music-only	3
6	Test	1	Test	3

Table 6.5 Order of events, Primary School A and Primary School A1

6.2.4.10

Week	Activity (Group B)	Piece	Activity (Group B)	Piece
1	Words-Music	2	Music-only	3
2	Test	2	Test	3
3	Words-only	1	Words- Music	2
4	Test	1	Test	2
5	Music-only	3	Words-only	1
6	Test	3	Test	1

Table 6.6 Order of events, Primary School B and Primary School B1

6.2.4.11 Learning Phase: Weeks 1, 3, 5

Within the ASC group, participants were at all times accompanied by a teacher or teaching assistant, who was familiar with the child, so as to facilitate co-operation and communication, and to make the child feel at ease. Head teachers were asked to provide a small room that as far as possible was distraction free (in terms of both sound and vision) and would be consistently available throughout the duration of the study. In the event this was not entirely possible, although as far as the researcher was able to ascertain, the fact that the room where trials were conducted sometimes changed did not have a negative impact on the children's performance in the tests.

6.2.4.12 During the learning phase of the study, once children had entered the room they were given time to sit down and to settle. Once the participant was comfortable, he or she was asked to look at the A3 size laminated poster. As stated above, the main purpose of the poster was to serve as a prompt in the recall phase. A secondary reason for its inclusion was to enable participants to focus on the activities to follow.

6.2.4.13 All materials used through the three conditions (comprising word-only, music-only, and words-and-music) were played to participants using the external speakers of a lap-top. The volume of the music was set at a comfortable listening level.

6.2.4.14 The order of events for both the ASC group and the comparison group in the learning phase conformed to the following schedule:

Warm-up

After meeting and greeting, children were asked to take a seat in front of the poster. Once they had been allowed to settle, they were asked about the poster and whether they could name any of the characters depicted; then the following schedule was followed:

- | | |
|---------|--|
| Step 1 | The piece was played all the way through |
| Step 2 | The piece was played for a second time all the way through |
| Step 3 | Line 1 was played |
| Step 4 | Participants were asked to repeat line 1 |
| Step 5 | Line 2 was played |
| Step 6 | Participants were asked to repeat line 2 |
| Step 7 | Line 3 was played |
| Step 8 | Participants were asked to repeat line 3 |
| Step 9 | Line 4 was played |
| Step 10 | Participants were asked to repeat line 4 |

Steps 3 to 10 repeated

- | | |
|---------|--|
| Step 11 | The piece was again played in its entirety |
| Step 12 | Participants were asked to repeat the entire piece |

6.2.4.15 There was a certain flexibility in the length of time between steps, to enable children to overcome any response to internal or external distractions. For the children with ASC, sessions throughout the learning phase were between three and five minutes in duration, while for the comparison group sessions ran from between three and four minutes.

6.2.4.16 **Recall Phase: Weeks 2, 4, 6**

Warm-up

After meeting and greeting, children were asked to take a seat in front of the poster. Once they had been allowed to settle, they were informed that they would be asked what they could remember from the material they had heard the previous week. The following schedule was then followed:

- | | |
|--------|--|
| Step 1 | The participants were asked what they could recall from the previous week |
| Step 2 | The participants were given the chance to sing or narrate material |
| Step 3 | If there was no response, one word (or note) was played back to the participant |
| Step 4 | Participants were given the chance to sing or narrate material |
| Step 5 | If there was no response, two words (or notes) were played back to the participant |
| Step 6 | Participants were given the chance to sing or narrate material |
| Step 7 | If there was no response, the four words (or notes) were played back |
| Step 8 | Participants were given the chance to repeat material |
| Step 9 | If still no response, up to half the piece was played to the participant |

Step 10 Participants were given the chance to sing or narrate material

6.2.4.17 The amount of cueing was recorded by the researcher and was taken into account in the scoring system, whereby any words (or fragments of melody) played to participants that were correctly repeated were not counted. In total, test times varied between one and four minutes, depending on the extent to which the participants were on task.

6.2.5 **Transcription and analysis**

6.2.5.1 All sessions were transcribed manually (words and music). Everything the participants said was recorded on a time line, which included all breaks, pauses and repeats. Transcriptions were independently verified by my first supervisor, and where disagreements initially arose, these were resolved through discussion.

6.2.5.2 With regard to verbal recall, the accuracy of responses was gauged in relation to four parameters – semantics, syntax, sound and sequence (Ockelford: 2013, p. 29). This taxonomy had previously been used by Kitain (2013) in a similar context, and it accords with areas of language which research has suggested may be particularly challenging for children with ASC, including articulation (Kjelgaard & Tager-Flusberg 2001; Pierce & Bartolucci 1977), syntax (Tager-Flusberg 1990; Tager-Flusberg 2004), and semantics (Tager-Flusberg 1991).

6.2.5.3 I now present an example of how the responses for verbal recall were scored. Participant 55 in the words-only condition in the learning phase was asked to recite the words from piece 2:

‘Sing a song for Thomas, this is how it goes.

Can you see his wheels, and can you see his nose.’

6.2.5.4 The participant responded:

‘Sing a song for Thomas, this how it goes.

You see his wheels, and see his nose.’

Line 1:

Semantics

Stimulus

SING	A	SONG	FOR	THOMAS	THIS	IS	HOW	IT	GOES
------	---	------	-----	--------	------	----	-----	----	------

Response

SING	A	SONG	FOR	THOMAS	THIS		HOW	IT	GOES
------	---	------	-----	--------	------	--	-----	----	------

Score

1	1	1	1	1	1	0	1	1	1
---	---	---	---	---	---	---	---	---	---

9/10

Sound

Stimulus

SING	A	SONG	FOR	THOMAS	THIS	IS	HOW	IT	GOES
------	---	------	-----	--------	------	----	-----	----	------

Response

SING	A	SONG	FOR	THOMAS	THIS		HOW	IT	GOES
------	---	------	-----	--------	------	--	-----	----	------

Score

1	1	1	1	1	1	0	1	1	1
---	---	---	---	---	---	---	---	---	---

9/10

Syntax

Stimulus

SING	A	SONG	FOR	THOMAS	THIS	IS	HOW	IT	GOES
------	---	------	-----	--------	------	----	-----	----	------

Response

SING	A	SONG	FOR	THOMAS	THIS		HOW	IT	GOES
------	---	------	-----	--------	------	--	-----	----	------

Score

1	1	1	1	1	1	0	1	1	1
---	---	---	---	---	---	---	---	---	---

9/10

Sequence

Stimulus

SING	A	SONG	FOR	THOMAS	THIS	IS	HOW	IT	GOES
------	---	------	-----	--------	------	----	-----	----	------

Response

SING	A	SONG	FOR	THOMAS	THIS		HOW	IT	GOES
------	---	------	-----	--------	------	--	-----	----	------

Score

1	1	1	1	1	1	0	1	1	1
---	---	---	---	---	---	---	---	---	---

9/10

6.2.5.5 Line 2:

Semantics

Stimulus

CAN	YOU	SEE	HIS	WHEELS	AND	CAN	YOU	SEE	HIS	NOSE
-----	-----	-----	-----	--------	-----	-----	-----	-----	-----	------

Response

	YOU	SEE	HIS	WHEELS	AND			SEE	HIS	NOSE
--	-----	-----	-----	--------	-----	--	--	-----	-----	------

Score

0	1	1	1	1	1	0	0	1	1	1
---	---	---	---	---	---	---	---	---	---	---

8/11

Sound

Stimulus

CAN	YOU	SEE	HIS	WHEELS	AND	CAN	YOU	SEE	HIS	NOSE
-----	-----	-----	-----	--------	-----	-----	-----	-----	-----	------

Response

	YOU	SEE	HIS	WHEELS	AND			SEE	HIS	NOSE
--	-----	-----	-----	--------	-----	--	--	-----	-----	------

Score

0	1	1	1	1	1	0	0	1	1	1
---	---	---	---	---	---	---	---	---	---	---

8/11

Syntax

Stimulus

CAN	YOU	SEE	HIS	WHEELS	AND	CAN	YOU	SEE	HIS	NOSE
-----	-----	-----	-----	--------	-----	-----	-----	-----	-----	------

Response

	YOU	SEE	HIS	WHEELS	AND			SEE	HIS	NOSE
--	-----	-----	-----	--------	-----	--	--	-----	-----	------

Score

0	1	1	1	1	1	0	0	1	1	1
---	---	---	---	---	---	---	---	---	---	---

8/11

Sequence

Stimulus

CAN	YOU	SEE	HIS	WHEELS	AND	CAN	YOU	SEE	HIS	NOSE
-----	-----	-----	-----	--------	-----	-----	-----	-----	-----	------

Response

	YOU	SEE	HIS	WHEELS	AND			SEE	HIS	NOSE
--	-----	-----	-----	--------	-----	--	--	-----	-----	------

Score

0	1	1	1	1	1	0	0	1	1	1
---	---	---	---	---	---	---	---	---	---	---

8/11

6.2.5.6 In this case, there was no difference between the four parameters, since the errors consisted only of omissions, which affected semantics, syntax, sound and sequence equally. The transcription is presented on the next page, where anything the researcher or the participant said, or sang, appears with a time line.

6.2.5.7 Participant 55: learning phase, words-only

Time line: 3:30

3:35

3:40

Participant Melody

Participant Speech

Sing a song for Thomas this how it goes	You see his wheels and see his nose
---	-------------------------------------

Participant Actions

--	--

Researcher Melody

Researcher Speech

	Very good fantastic well done
--	-------------------------------

Pre-recorded Speech

Sing a song for Thomas this is how it goes	
Can you see his wheels and can you see his nose	

6.2.5.8 A point was allocated for every correct word that the participant recalled, and for any words that were omitted, no points were given. This was applicable across all of the linguistic subcategories, i.e. for semantics, sound, syntax and sequence. The final

score for this response was 17 out of a possible 21 across each linguistic sub-categories; thus, for this participant, the total score was 68 points out of a possible 84 (or 81%).

6.2.5.9 An example of how some responses could be correct with regard to certain parameters of speech and not others is to be found in Participant 46's response. At the end of the music-and-words condition in the learning phase the participant was asked to sing the whole of piece 1:

'I can tell you what I can see.

I can see the engines 1 2 3.'

6.2.5.10 Her response was:

'I can tell you watch.

I can see the Ener-ener gine.'

A transcription is presented on the next page.

6.2.5.11 Participant: 46

20

30

40

Participant Melody

Participant Speech

	I can tell you watch. I can see the ener-ener-gine
--	--

Participant Actions

--	--

Researcher Melody

Researcher Speech

Okay last time have a listen	Fantastic well done
------------------------------	---------------------

Pre Recorded Melody

Pre Recorded singing and speech

I can tell you what I can see I can see the engines 123	
--	--

6.2.5.12 The score for this participant was therefore as follows:

Line:1

Semantics

Stimulus

I	CAN	TELL	YOU	WHAT	I	CAN	SEE
---	-----	------	-----	------	---	-----	-----

Response

I	CAN	TELL	YOU	WATCH			
---	-----	------	-----	-------	--	--	--

Score

1	1	1	1	1	0	0	0
---	---	---	---	---	---	---	---

5/8

Sound

Stimulus

I	CAN	TELL	YOU	WHAT	I	CAN	SEE
---	-----	------	-----	------	---	-----	-----

Response

I	CAN	TELL	YOU	WATCH			
---	-----	------	-----	-------	--	--	--

Score

1	1	1	1	0.5	0	0	0
---	---	---	---	-----	---	---	---

4.5/8

Syntax

Stimulus

I	CAN	TELL	YOU	WHAT	I	CAN	SEE
---	-----	------	-----	------	---	-----	-----

Response

I	CAN	TELL	YOU	WATCH			
---	-----	------	-----	-------	--	--	--

Score

1	1	1	1	1	0	0	0
---	---	---	---	---	---	---	---

5/8

Sequence

Stimulus

I	CAN	TELL	YOU	WHAT	I	CAN	SEE
---	-----	------	-----	------	---	-----	-----

Response

I	CAN	TELL	YOU	WATCH			
---	-----	------	-----	-------	--	--	--

Score

1	1	1	1	1	0	0	0
---	---	---	---	---	---	---	---

5/8

6.2.5.13 Line 2:

Semantics

Stimulus

I	CAN	SEE	THE	ENGINES	1	2	3
---	-----	-----	-----	---------	---	---	---

Response

I	CAN	SEE	THE	ENER-ENER- GINE			
---	-----	-----	-----	--------------------	--	--	--

Score

1	1	1	1	1	0	0	0
---	---	---	---	---	---	---	---

5/8

Sound

Stimulus

I	CAN	SEE	THE	ENGINE	1	2	3
---	-----	-----	-----	--------	---	---	---

Response

I	CAN	SEE	THE	ENER-ENER- GINE			
---	-----	-----	-----	--------------------	--	--	--

Score

1	1	1	1	0.5	0	0	0
---	---	---	---	-----	---	---	---

5/8

Syntax

Stimulus

I	CAN	SEE	THE	ENGINE	1	2	3
---	-----	-----	-----	--------	---	---	---

Response

I	CAN	SEE	THE	ENER-ENER- GINE			
---	-----	-----	-----	--------------------	--	--	--

Score

1	1	1	1	1	0	0	0
---	---	---	---	---	---	---	---

5/8

Sequence

Stimulus

I	CAN	SEE	THE	ENGINE	1	2	3
---	-----	-----	-----	--------	---	---	---

Response

I	CAN	SEE	THE	ENER-ENER- GINE			
---	-----	-----	-----	--------------------	--	--	--

Score

1	1	1	1	1	0	0	0
---	---	---	---	---	---	---	---

5/8

6.2.5.14 This participant achieved maximum scores across all linguistic subcategories for correctly reciting the words, ‘I can tell you’ and ‘I can see the’. With regard to the participant saying ‘Watch’, in terms of sound, this was incorrect. However, as she had merely substituted a ‘t’ sound for a ‘ch’ sound, and other than that, the word would be correct from a phonetical perspective, 0.5 was allocated for sound, and 1 for the other linguistic subcategories. With regard to the participant saying ‘ener-ener-gine,’ again 0.5 was given with regard to sound, and 1 was allocated in the other linguistic subcategories.

6.2.5.15 The overall score for this participant was therefore 39/64 or 61%. This was broken down within the linguistic subcategories as:

Syntax 62.5%

Sound 56%

Semantics 62.5%

Sequence 62.5%

6.2.5.16 Another example of a more complex response to analyse, is the attempt by participant 41, who was required to sing piece 2 in the words-and-music condition of the recall phase :

‘Sing a song for Thomas, this is how it goes

Can you see his wheels, and, can you see his nose.’

6.2.5.17 The response from this participant was as follows:

‘Thomas how it goes. Can oo ee is nose’

The full transcription is presented on the next page:

6.2.5.18 Participant: 41

20

30

40

Participant Melody

Participant Speech

	Thomas how it goes can oo ee is nose
--	--------------------------------------

Participant Actions

--	--

Researcher Melody

Researcher Speech

Okay, listen to this for the last time	Fantastic well done
--	---------------------

Pre Recorded Melody

Pre Recorded singing and speech

Sing a song for Thomas this is how it goes Can you see his wheels and can you see his nose	
---	--

6.2.5.19 The score for language was:

Line 1: Semantics

Stimulus

SING	A	SONG	FOR	THOMAS	THIS	IS	HOW	IT	GOES
------	---	------	-----	--------	------	----	-----	----	------

Response

				THOMAS			HOW	IT	GOES
--	--	--	--	--------	--	--	-----	----	------

Score

0	0	0	0	1	0	0	1	1	1
---	---	---	---	---	---	---	---	---	---

4/10

Sound

Stimulus

SING	A	SONG	FOR	THOMAS	THIS	IS	HOW	IT	GOES
------	---	------	-----	--------	------	----	-----	----	------

Response

				THOMAS			HOW	IT	GOES
--	--	--	--	--------	--	--	-----	----	------

Score

0	0	0	0	1	0	0	1	1	1
---	---	---	---	---	---	---	---	---	---

4/10

Syntax

Stimulus

SING	A	SONG	FOR	THOMAS	THIS	IS	HOW	IT	GOES
------	---	------	-----	--------	------	----	-----	----	------

Response

				THOMAS			HOW	IT	GOES
--	--	--	--	--------	--	--	-----	----	------

Score

0	0	0	0	1	0	0	1	1	1
---	---	---	---	---	---	---	---	---	---

4/10

Sequence

Stimulus

SING	A	SONG	FOR	THOMAS	THIS	IS	HOW	IT	GOES
------	---	------	-----	--------	------	----	-----	----	------

Response

				THOMAS			HOW	IT	GOES
--	--	--	--	--------	--	--	-----	----	------

Score

0	0	0	0	1	0	0	1	1	1
---	---	---	---	---	---	---	---	---	---

4/10

6.2.5.20 Line 2:

Semantics

Stimulus

CAN	YOU	SEE	HIS	WHEELS	AND	CAN	YOU	SEE	HIS	NOSE
-----	-----	-----	-----	--------	-----	-----	-----	-----	-----	------

Response

						CAN	OO	EE	IS	NOSE
--	--	--	--	--	--	-----	----	----	----	------

Score

0	0	0	0	0	0	1	1	1	1	1
---	---	---	---	---	---	---	---	---	---	---

5/11

Sound

Stimulus

CAN	YOU	SEE	HIS	WHEELS	AND	CAN	YOU	SEE	HIS	NOSE
-----	-----	-----	-----	--------	-----	-----	-----	-----	-----	------

Response

						CAN	OO	EE	IS	NOSE
--	--	--	--	--	--	-----	----	----	----	------

Score

0	0	0	0	0	0	1	0.5	0.5	0.5	1
---	---	---	---	---	---	---	-----	-----	-----	---

3.5/11

Syntax

Stimulus

CAN	YOU	SEE	HIS	WHEELS	AND	CAN	YOU	SEE	HIS	NOSE
-----	-----	-----	-----	--------	-----	-----	-----	-----	-----	------

Response

						CAN	OO	EE	IS	NOSE
--	--	--	--	--	--	-----	----	----	----	------

Score

0	0	0	0	0		1	1	1	1	1
---	---	---	---	---	--	---	---	---	---	---

5/11

Sequence

Stimulus

CAN	YOU	SEE	HIS	WHEELS	AND	CAN	YOU	SEE	HIS	NOSE
-----	-----	-----	-----	--------	-----	-----	-----	-----	-----	------

Response

						CAN	OO	EE	IS	NOSE
--	--	--	--	--	--	-----	----	----	----	------

Score

0	0	0	0	0	0	1	0.5	0.5	0.5	1
---	---	---	---	---	---	---	-----	-----	-----	---

5/11

6.2.5.21 He managed to correctly recall ‘Thomas,’ and ‘how it goes,’ from the first line. This response was deemed to have an accuracy of 40% in relation to each of semantics, syntax, sound and sequence. From the second line he sang, ‘can *oo-ee- is* nose.’ This participant thus achieved full points across all subcategories of sound for reciting ‘can’ and ‘nose’ correctly. With regard to the participant reciting ‘oo-ee-is’, this was considered to be partially correct and thus this participant obtained 0.5 with regard to the subcategory of sound, as it was clear to me that he was attempting to say ‘you see his’. For all other sub - categories, ‘oo-ee-is’ was considered to be correct. Thus out of a total of 84 points he obtained a total of 34.5 (or 41 %), which can be broken down into the separate linguistic subcategories as follows:

Syntax	43%
Sound	36%
Semantics	43%
Sequence	43%

6.2.5.22 With regard to scoring responses for melodic recall, scores were marked for both rhythm and for pitch. For instance, as shown below in piece 2, a score of 22 was available for rhythm and 22 for pitch. With reference to pitch, if a starting note was incorrect, but the interval between the next note and the following notes were correct, then from the second note onward, notes would be marked as correct. For, as discussed in the review of the literature, zygonic theory states, ‘all musical structure ultimately depends on relationships’ (Ockelford 2013: p.75), and it is the sense of derivation from patterns between the elements of a melody that allows music to make sense. Thus, if the correct patterns with regard to pitch were recognised, then this was recorded in the final score.

6.2.5.23 With regard to the assessment of rhythmic response, both length of note and inter-onset between notes was taken into account. I now present this participant's attempt to recall the melody from piece 2 in the music-only condition in the learning phase of the study.

Participant 33- ASC group - Learning Phase - Music Only
SCORES FOR MELODY - LINE 1

Stimulus

Response

Stimulus

Response

Participant 33 ASC group - Learning Phase - Music Only

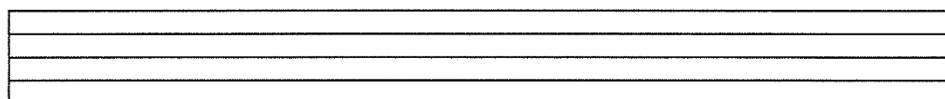
SCORES FOR MELODY

LINE 2

Stimulus

5/6

Response



Stimulus

2/5

Response

Participant 33 - ASC group - Learning Phase - music only
Scores for RHYTHM - LINE 2

Stimulus

Response

Stimulus

Response

6.2.5.24 In the first bar the participant started on the correct note, and as the third, fourth and fifth notes were correct with regard to pitch interval between the notes, the participant obtained a score of 4 in this bar. In the second bar, the participant started on the wrong note, but the interval and contour of the first four notes were correct, and thus in this bar the participant obtained a score of three. In the third bar, the participant again started on the right note, the relation in pitch between the first, second, fourth and fifth notes was correct, and the sixth note repeating the pitch of the fifth note was also recognised; thus, the participant obtained a score of five. In the last bar, the participant obtained a score of two for pitch. The reasoning behind

this was that, although the starting note was a tone lower than the stimulus starting note, the second note was pitched at the correct interval to the starting note. The participant also pitched the last note correctly, thus gaining a second mark with regard to pitch.

6.2.5.25 The participant obtained the maximum possible score for rhythm in both line one and line two, and as lines one and two are exactly the same, only the transcription of the score for rhythm in line two is presented.

6:3 Results

Learning Phase

6.3.1 In this section I present the scores obtained with regard to verbal recall in the short term by the ASC group.

6.3.1.1

Participant	Language Score words-only	Language Score words-and-music
1	100	94
2	100	100
3	43	44
4	44	25
5	44	94
6	88	100
7	47	69
8	56	37
9	13	41
10	100	76
11	0	0
12	75	84
13	53	44
14	100	53
15	73	75
16	100	100
17	100	91
18	71	84
19	100	100
20	92	64
21	100	100
22	48	62
23	81	100
24	100	81

Table 6.7 Verbal recall for ASC group, learning phase N=24

6.3.1.2

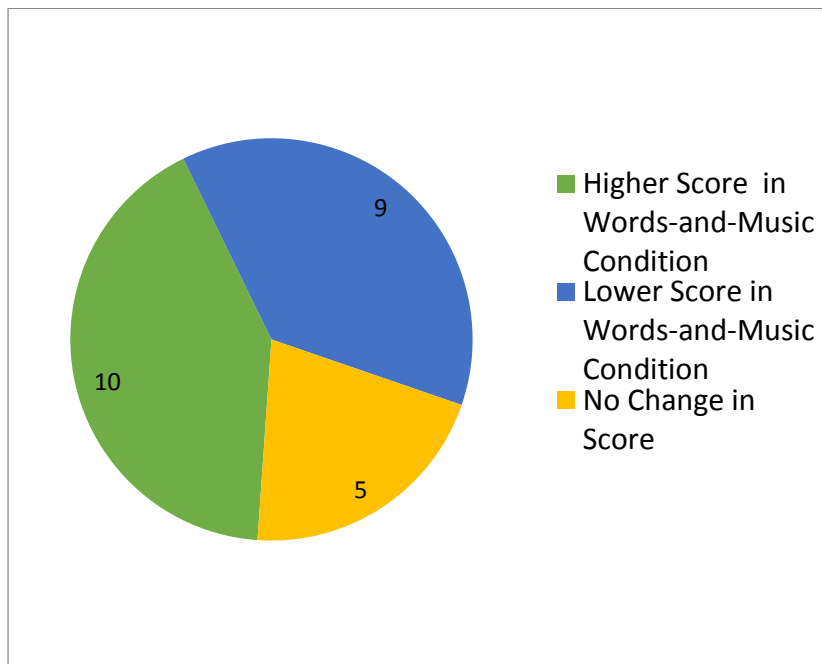


Figure 6.8 ASC group: scores for verbal recall across conditions, learning phase

N=24

6.3.1.3

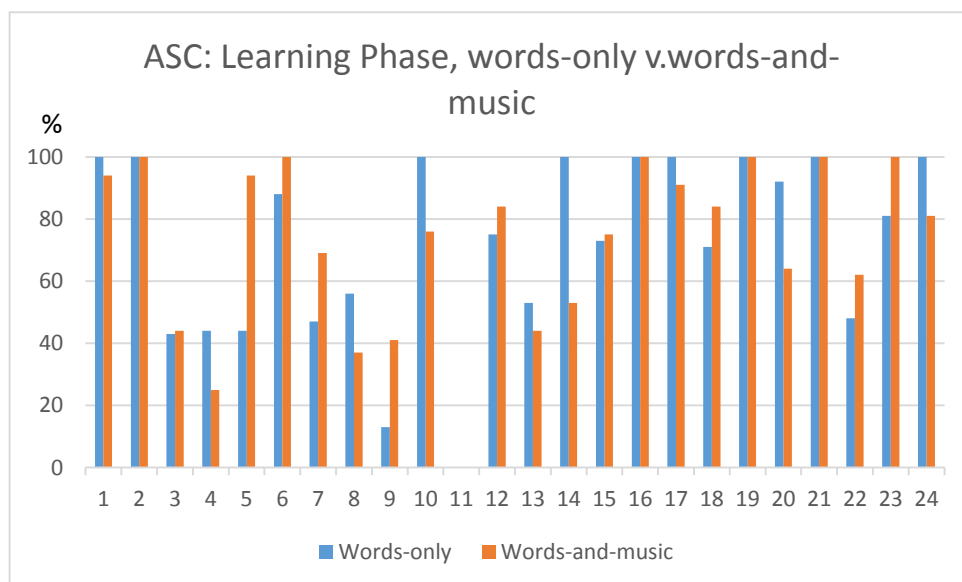


Figure 6.9 ASC Scores for verbal recall, learning phase N=24

With regard to recall in the short term, the effect of music on verbal learning was diverse for children with ASC, with no general overall effect discernible.

6.3.1.4

	N (participants)	Minimum %	Maximum %	Mean %	Std. Deviation
Word Only	24	0	100	72	29.9
Words Music	24	0	100	72	28.0
Syntax Words Only	24	0	100	72	30.4
Syntax Words Music	24	0	100	72	28.8
Sound Words Only	24	0	100	72	29.8
Sound Words Music	24	0	100	72	27.2
Semantics Words Only	24	0	100	72	30.4
Semantics Words Music	24	0	100	71	28.9
Sequence Words Only	24	0	100	72	30.5
Sequence Words Music	24	0	100	72	27.4

Table 6.8 ASC group: Verbal Recall Scores: Syntax, Sound, Semantics, Sequence

N=24

6.3.1.5 Language scores were made up of four separate categories: syntax, sound, semantics and sequence. As the results show, there was no significant difference between scores obtained within any of the different subcategories for children with ASC within the learning phase.

6.3.2 I now present Verbal scores obtained for recall in the short term by the comparison group.

6.3.2.1

Participant	Language Score Words-only	Language Score Words-and-music
1	100	100
2	100	100
3	100	100
4	100	100
5	100	100
6	100	100
7	100	100
8	95	100
9	98	100
10	100	100
11	100	100
12	100	100
13	100	100
14	100	100
15	100	100
16	100	100
17	100	100
18	100	100
19	100	100
20	100	100
21	100	100
22	94	100
23	100	100
24	94	98
25	100	100
26	100	95
27	100	98
28	100	95
29	94	95
30	100	100
31	100	98
32	100	95

Table 6.9 Verbal recall score for comparison group, learning phase

N=32

6.3.2.2

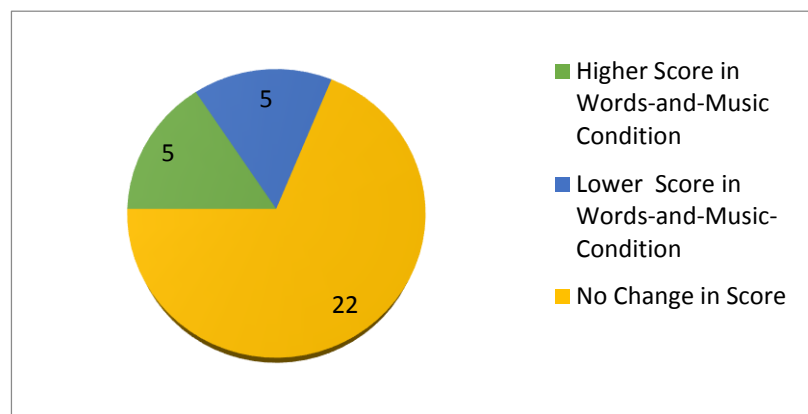


Figure 6.10 Comparison group: scores for verbal recall across conditions, learning phase

N=32

6.3.2.3

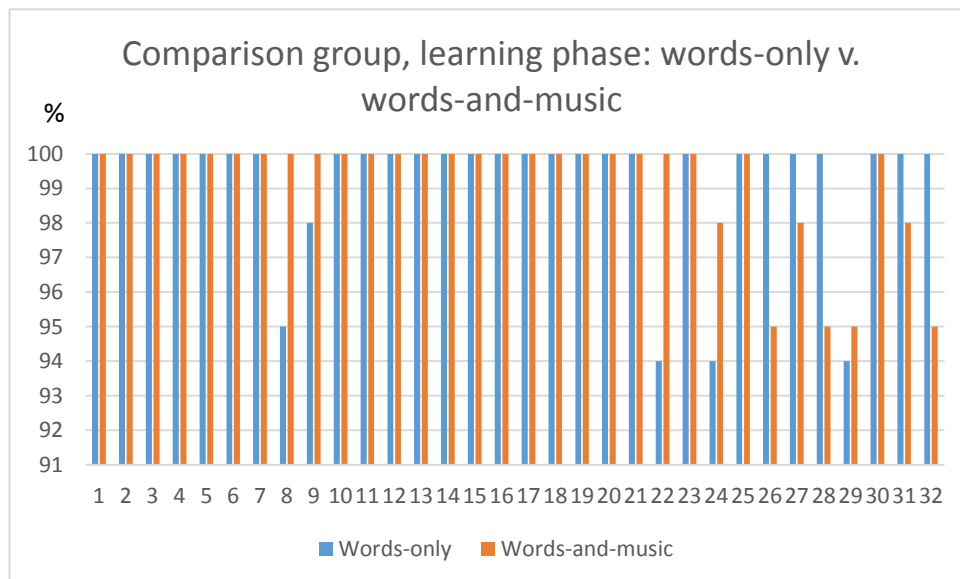


Figure 6.11 Comparison group scores for verbal recall, learning phase N=32

With regard to scores obtained for verbal recall in the learning phase, for most children there was a ceiling effect. For one group of five participants, scores were

slightly lower in the words-and-music phase when compared to the music-only condition, and for one group of five children scores were slightly higher, although the difference in scores between conditions was never more than 6%.

6.3.2.4

	N	Minimum %	Maximum %	Mean	Std. Deviation
Word Only	32	94	100	99	1.9
Words Music	32	95	100	99	1.7
Syntax Words Only	32	94	100	99	2.1
Syntax Words Music	32	94	100	99	1.9
Sound Words Only	32	87	100	99	2.8
Sound Words Music	32	95	100	99	2.1
Semantics Words Only	32	87	100	99	2.9
Semantics Words Music	32	94	100	99	1.9
Sequence Words Only	32	87	100	99	2.8
Sequence Words Music	32	95	100	99	2.1

Table 6.10 Comparison group: Verbal Recall Scores:
Syntax, Sound, Semantics, Sequence: learning phase N=32

6.3.3 In this section we consider the music scores obtained in the learning phase by the ASC group.

6.3.3.1

Participant	Music Score Music-only	Music Score Music-and-Words
1	77	29
2	97	100
3	0	26
4	23	23
5	5	83
6	97	74
7	16	35
8	5	46
9	30	40
10	0	14
11	0	0
12	56	71
13	58	28
14	37	11
15	40	46
16	100	100
17	72	49
18	73	74
19	60	55
20	68	51
21	94	100
22	36	31
23	58	55
24	78	88

Table 6.11 Melodic recall score for ASC group, learning phase N=24

6.3.3.2

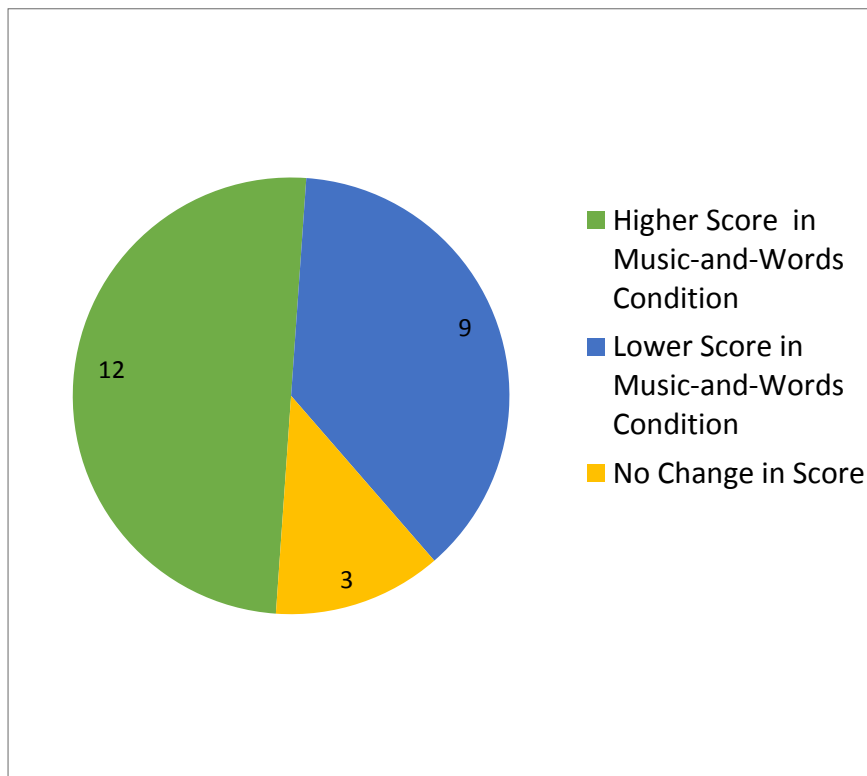


Figure 6.12 ASC group: scores for musical recall across conditions, learning phase

N=24

6.3.3.3

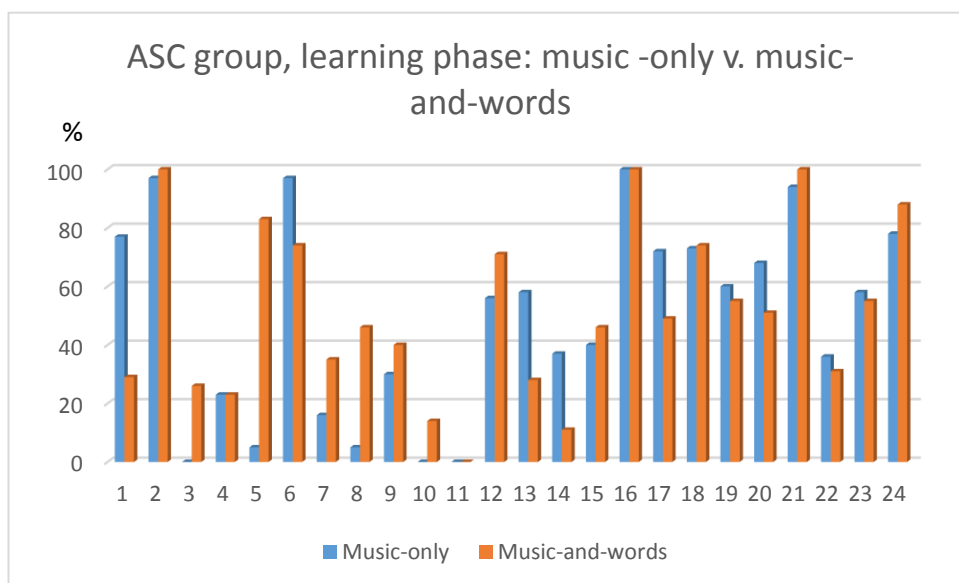


Figure 6.13 ASC group scores for melodic recall across conditions, recall phase N=24

6.3.3.4 The results showed that, for the children with ASC in the learning phase of the study the effects of the presence of words on music recall was once again varied. For twelve participants, scores for music recall were greater in the presence of words, while for nine participants scores for music recall were greater in the music only condition. For the remaining three participants, the scores remained the same across conditions.

6.3.3.5 However, for the 12 participants whose scores for melodic recall increased in the music-and-words condition (when compared to the music-only condition), seven participants scored between 0% and 40% in the music-only condition, whereas for the nine participants whose scores *decreased* in the music-and-words condition, six out of the nine participants scored between 58% and 77% in the music only condition. This suggests that, as musical ability increases for children with ASC within the cohort studied, the beneficial effect of the presence of words on the recall of melody decreases.

6.3.4 In this section we consider the music scores obtained in the learning phase by the comparison group.

6.3.4.1 Melodic recall scores for comparison group, learning phase

Participant	Music Score Music-only	Music Score Music-and-Words
1	100	100
2	97	80.5
3	81	78
4	89	88.5
5	94.5	100
6	65	50
7	94.5	100
8	68	75
9	70.5	100
10	95	94
11	91.5	97
12	68	61
13	100	100
14	92	100
15	76	97
16	76	100
17	84	100
18	81	100
19	75.5	94
20	94.5	97
21	89	100
22	78.5	83.5
23	94.5	97.5
24	91.5	91
25	81	79.5
26	55	77
27	55	57
28	70.5	61.5
29	55	50
30	81.5	100
31	71	91
32	94.5	100

Table 6.12

N=32

6.3.4.2

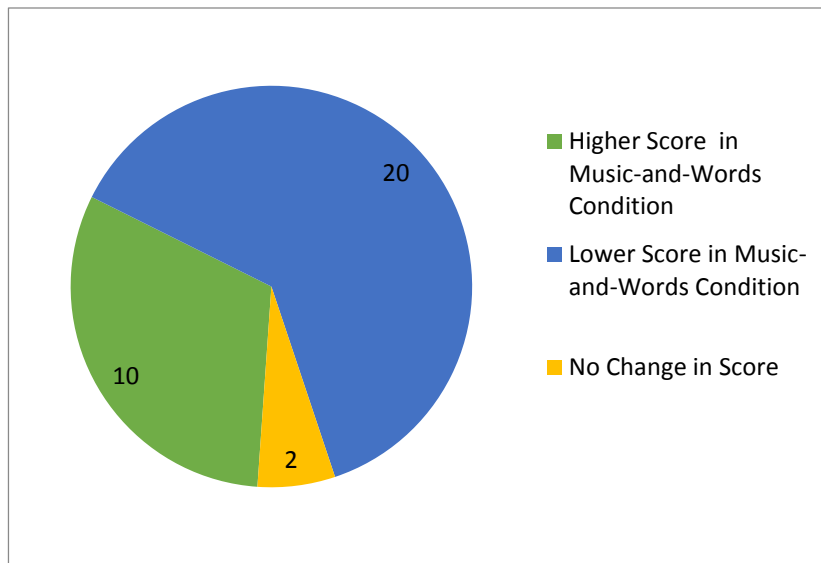


Figure 6.14 Comparison group: scores for melodic recall across conditions, learning phase

N=32

6.3.4.3

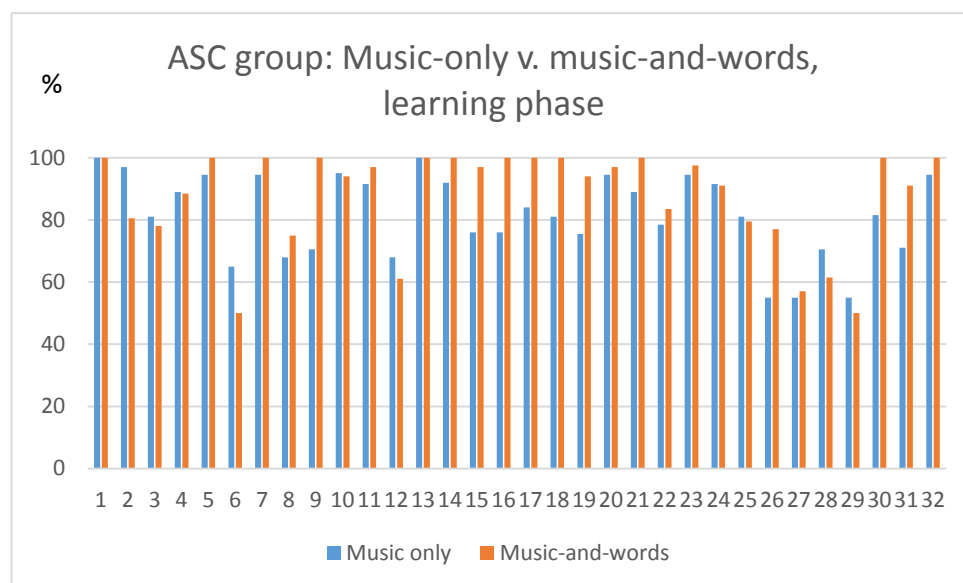


Figure 6.15 Comparison group scores for melodic recall across conditions, learning phase

N=32

6.3.4.4 The effects of the presence of language on melody was diverse for the comparison group as a whole. Two participants scored 100% in each condition. For 20 participants, scores were lower in the music-and-words condition than the words-only condition, and for 10 participants, scores were higher.

6.3.4.5

	N (Participants)	Minimum %	Maximum %	Mean	Std. Deviation
Music-only	32	55	100	82	13.4
Words-and-music	32	50	100	87	16.0
Pitch Music Only	32	16	100	71	24.2
Pitch Words Music	32	0	100	77	30.9
Rhythm Words Only	32	72	100	93	6.4
Rhythm Words Music	32	86	100	99	3.2

Table 6.13 Comparison group: melodic recall scores: learning phase

N=32

6.3.4.6 In the learning phase, the comparison group recalled rhythm better than pitch. In this respect the results were the same as the results found in the learning phase for the ASC group. Concerning scores obtained with regard to both pitch and rhythm, for both these subcategories of music recall, scores were higher in the music-and words condition than the music-only condition.

6.3.5 **KS1 v. KS2 Music-only v. music-and-words.**

6.3.5.1 When compared to scores for melodic recall obtained in the music-only condition, for 20 participants in the comparison group, scores increased in the music-and-words condition. For these participants the mean age was 8.6 years. For 10 participants in the comparison group, however, when compared to scores obtained in the music-only condition, scores for melodic recall were lower in the words-and-music condition. The mean age for children within this cohort was 7.2 years. A decision was therefore taken to divide the comparison group into two sub-groups: children aged 5 – 7, who are at the level of Key Stage 1(KS1), and children aged between 8 and 11, who are at the level of Key Stage 2 (KS2).

6.3.5.2

Participant	Music Score% Music-only	Music Score% Music-and-Words
1	78.5	83.5
2	94.5	97.5
3	91.5	91
4	81	79.5
5	55	77
6	55	57
7	70.5	61.5
8	55	50
9	71	91

Table 6.14 Melodic scores for KS1 group – learning phase
n=9

6.3.5.3

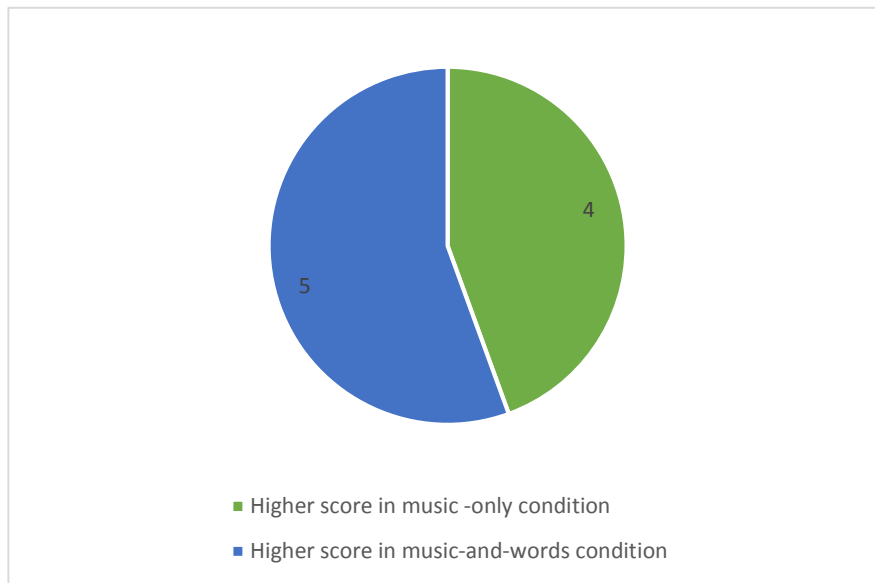


Figure 6.16 Scores for melodic recall across conditions: KS1 learning phase n=9

6.3.5.4

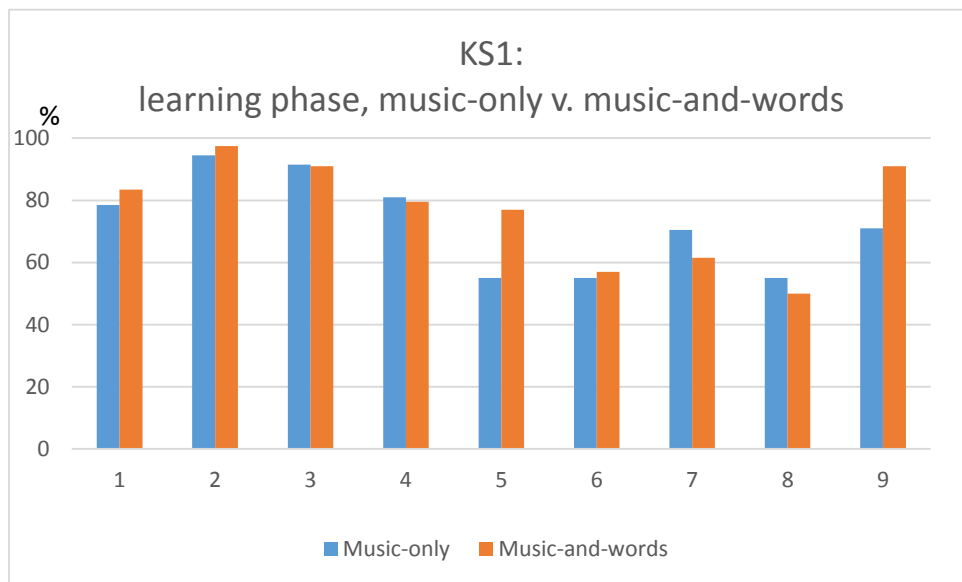


Figure 6.17 KS1 group scores for melodic recall, learning phase n=9

6.3.5.5 For four participants scores for melodic recall were higher in the music only condition. For this cohort, the mean score was 75% in the music-only condition, and 70% in the music-and-words condition. For the remaining five participants the mean score obtained in the music-only condition was 71%, while in the music-and-words condition it was 81%. Thus, the effect of the presence of language on melodic recall was variable for neurotypical children at the level of KS1.

6.3.5.6

Participant	Music Score Music-only	Music Score Music-and-Words
1	100	100
2	97	80.5
3	81	78
4	89	88.5
5	94.5	100
6	65	50
7	94.5	100
8	68	75
9	70.5	100
10	95	94
11	91.5	97
12	68	61
13	100	100
14	92	100
15	76	97
16	76	100
16	84	100
18	81	100
19	75.5	94
20	94.5	97
21	89	100
22	81.5	100
23	94.5	100

Figure 6.15 KS2 group: music-only v. music-and-words, learning phase
n=23

6.3.5.7

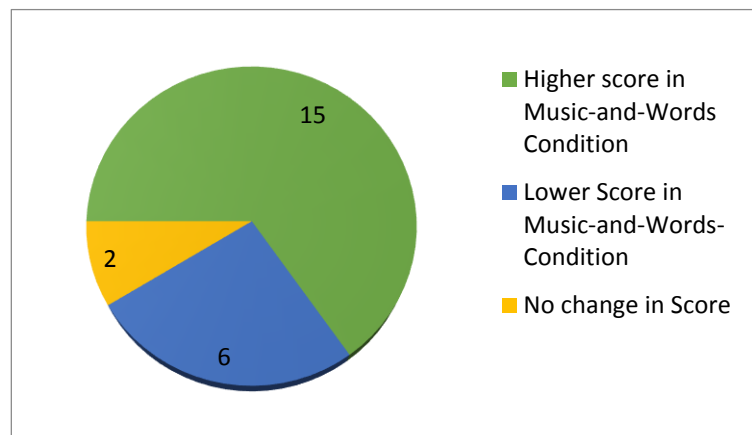


Figure 6.18 Scores for melodic recall across conditions: KS2 group, learning phase
n=23

6.3.5.8

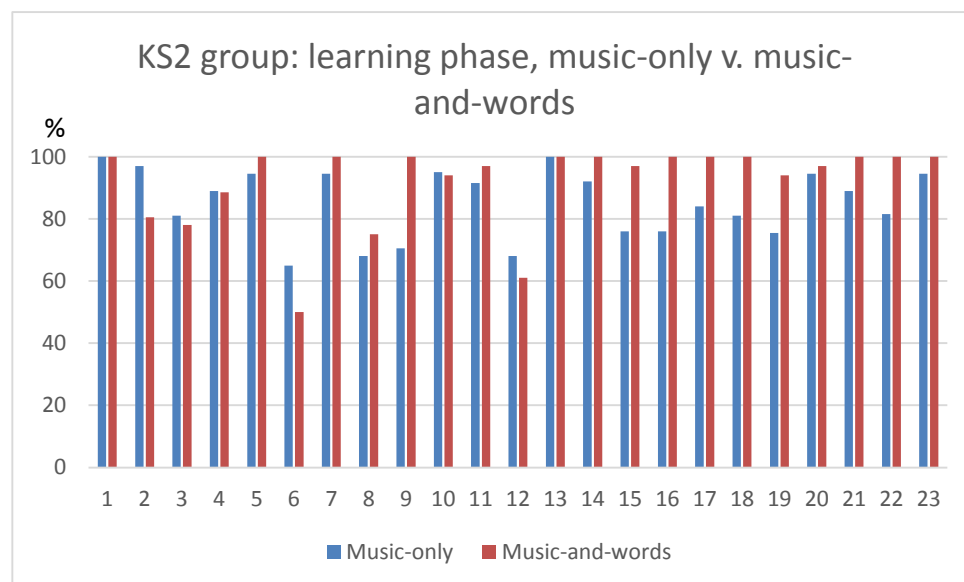


Figure 6.19 KS2 group: scores for melodic recall, learning phase
n=23

6.3.5.9 Two participants scored 100% in both the music-only condition and the music-and-words condition, thus indicating a ceiling effect. For six participants scores were higher in the music-only condition, when compared to the music-and-words condition. For the remaining 15 participants, scores were higher in the music-and-words condition when compared to the music-only condition. This suggests that, for children developing neurotypically at the level of KS2, the presence of words may enhance recall of melody.

Recall Phase

6.3.6 In this section we consider the scores obtained for verbal recall with regard to the long term by the ASC group.

6.3.6.1

Participant	Language Score Words-only	Language Score Words-and-Music
1	6	75
2	81	94
3	0	0
4	0	0
5	0	0
6	0	94
7	19	56
8	0	0
9	0	31
10	0	56
11	0	0
12	9	90.5
13	0	25
14	25	0
15	0	47
16	87.5	87
17	28	66
18	26.5	41
19	76	87.5
20	76	52.5
21	100	88
22	0	6
23	62	78
24	10	65.5

Table 6.16 Verbal recall for ASC group, recall phase N=24

6.3.6.2

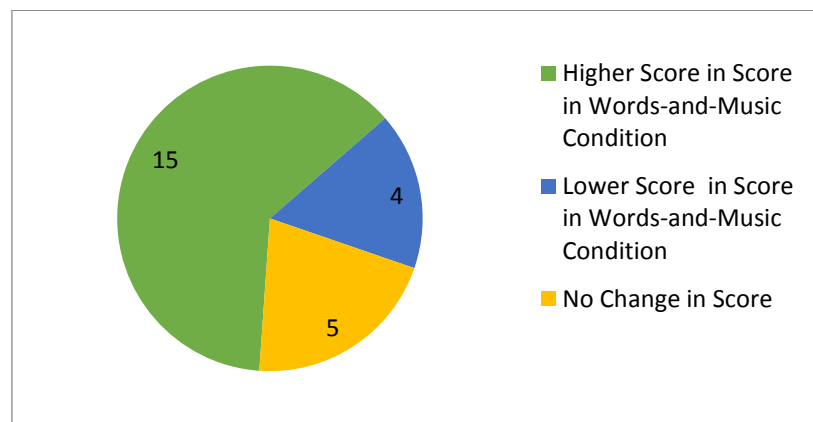


Figure 6.20 ASC group: scores for verbal recall across conditions, recall phase N=24

6.3.6.3

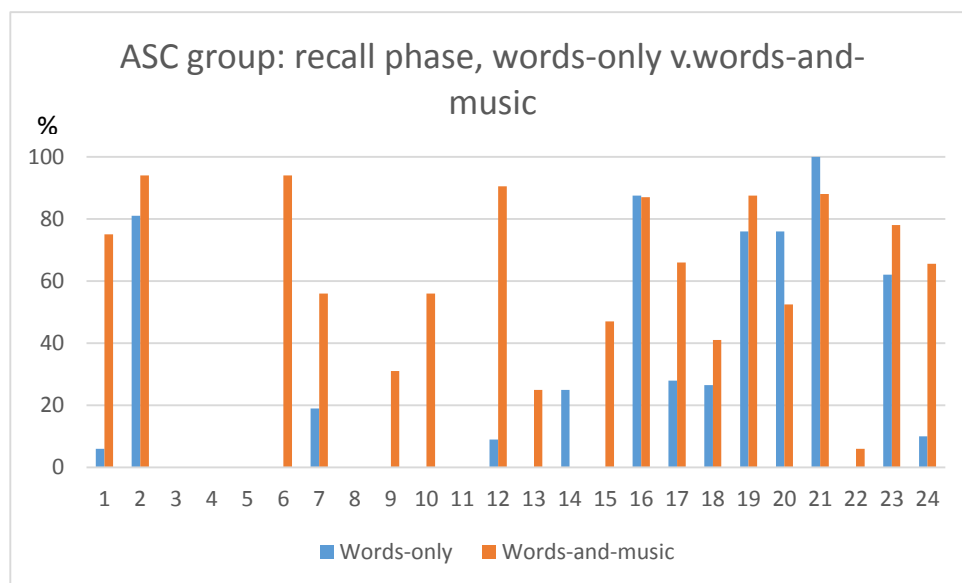


Figure 6.21 ASC group: scores for verbal recall, recall phase N=24

6.3.6.4 The presence of music had an enhancing effect on verbal recall for 15 of the 24 participants in the ASC group. For four participants, scores were lower in the words-

and-music phase than the words-only phase, and five participants scored 0% in each condition.

6.3.6.5

	N (participants)	Minimum %	Maximum %	Mean %	Std. Deviation
Word Only	24	0	100	25	34.3
Words Music	24	0	94	47	35.9
Syntax Words Only	24	0	100	25	33.7
Syntax Words Music	24	0	94	47	35.9
Sound Words Only	24	0	100	25	34.8
Sound Words Music	24	0	100	48	36.0
Semantics Words Only	24	0	100	26	34.8
Semantics Words Music	24	0	94	45	35.2
Sequence Words Only	24	0	100	25	34.0
Sequence Words Music	24	0	100	49	36.8

Table 6.17 Verbal recall scores: syntax, sound, semantics, sequence N=24

There was very little difference across linguistic subcategories in terms of verbal recall scores.

6.3.7 In this section we consider the scores obtained for verbal recall in the long term by the comparison group.

6.3.7.1

Participant	Language score words-only	Language score words-and-music
1	100	81
2	76	50
3	89	81
4	100	86
5	100	86
6	67	100
7	67	100
8	100	65
9	100	75
10	95	87
11	100	75
12	100	100
13	100	100
14	100	97
15	100	100
16	100	69
17	100	100
18	100	100
19	100	80
20	100	56
21	95	81
22	69	83.5
23	53	83.5
24	53	90.5
25	47	83
26	41	90.5
27	53	75
28	81	100
29	28	67
30	81	83.5
31	75	81
32	75	81

Table 6.18 Verbal recall: comparison group: recall phase N=32

6.3.7.2

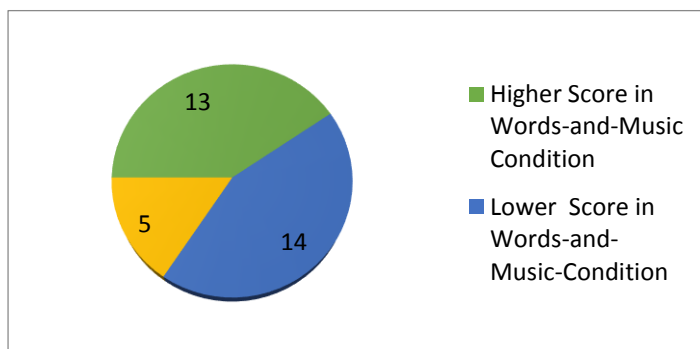


Figure 6.22 Scores for verbal recall across conditions, recall phase N=32

6.3.7.3

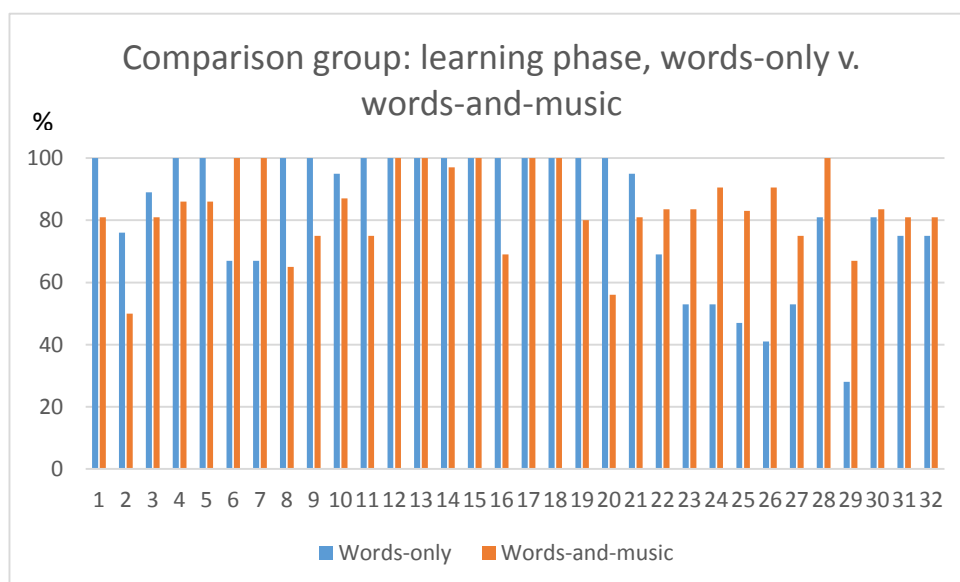


Figure 6.23 Comparison group: scores for verbal recall, recall phase N=32

6.3.7.4 For the neurotypical participants as a whole, in the recall phase music had little effect on language scores. The mean score obtained from the group in the words-only condition was 83%, while in the words-and-music condition it was 84%. It was of interest to note that the standard deviation in the words-only condition was 21.5%, as opposed to 13% in the words and music condition, illustrating how verbal recall scores obtained in the words-and-music condition were less variable.

6.3.7.5 Analysis was carried out within the sub-categories of language scores with regard to scores obtained for syntax, sound, semantics and sequence.

	N (participants)	Minimum %	Maximum %	Mean %	Std. Deviation
Word Only	32	28	100	82	21.5
Words Music	32	50	100	84	13.2
Syntax Words Only	32	28	100	83	20.9
Syntax Words Music	32	50	100	85	13.3
Sound Words Only	32	28	100	82	22.3
Sound Words Music	32	50	100	82	13.2
Semantics Words Only	32	28	100	83	20.9
Semantics Words Music	32	50	100	85	13.3
Sequence Words Only	32	28	100	82	22.3
Sequence Words Music	32	50	100	83	13.0

Table 6.19 Verbal recall scores: syntax, sound, semantics, sequence N=32

6.3.7.6 Scores obtained across all linguistic subcategories were virtually the same. Scores obtained with regard to syntax and semantics were slightly higher in both the words-only condition and the words-and-music condition compared to sound and sequence, though again the difference was minimal and thus of little significance.

6.3.7.7 When compared to scores obtained in the words-only condition, for 13 participants in the comparison group scores were higher in the words-and-music condition. For these participants, the mean age was 6.3 years. For 14 participants in the comparison group however, when compared to scores obtained in the words-only condition, scores for verbal recall were lower in the words-and music condition. The mean age for children within this cohort was 9.8.

6.3.8 Again, a decision was therefore taken to divide the comparison group into two subgroups: children aged 5 – 7 (Key Stage 1), and children aged between 8 and 11 (Key Stage 2).

6.3.8.1

Participant	Language Score Words-only	Language Score Words-and-Music
1	28	67
2	41	90.5
3	47	83
4	53	75
5	53	83.5
6	53	90.5
7	69	83.5
8	75	81
9	81	100

Table 6.20 KS1 group verbal recall: recall phase n=9

6.3.8.2

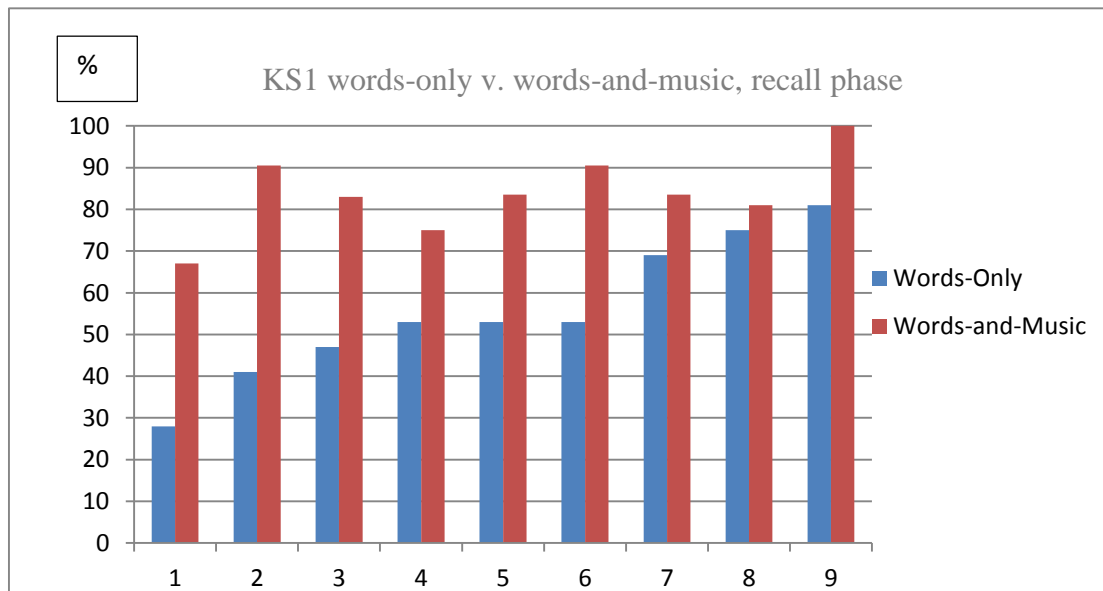


Figure 6.24 KS1 group: scores for verbal recall, recall phase n=9

6.3.8.3 The presence of music had a positive effect on language for the KS1 group, in that the mean score obtained in the words-only condition of 56% rose to 84% in the words and music condition. All participants obtained a higher score in the words-and-music condition when compared to the words-only condition.

6.3.8.4

Participant	Language Score Words-only	Language Score Words-and-Music
1	100	81
2	76	50
3	89	81
4	100	86
5	100	86
6	67	100
7	67	100
8	100	65
9	100	75
10	95	87
11	100	75
12	100	100
13	100	100
14	100	97
15	100	100
16	100	69
17	100	100
18	100	100
19	100	80
20	100	56
21	95	81
22	81	83.5
23	75	81

Table 6.21 KS2 group verbal recall: recall phase n=23

6.3.8.5

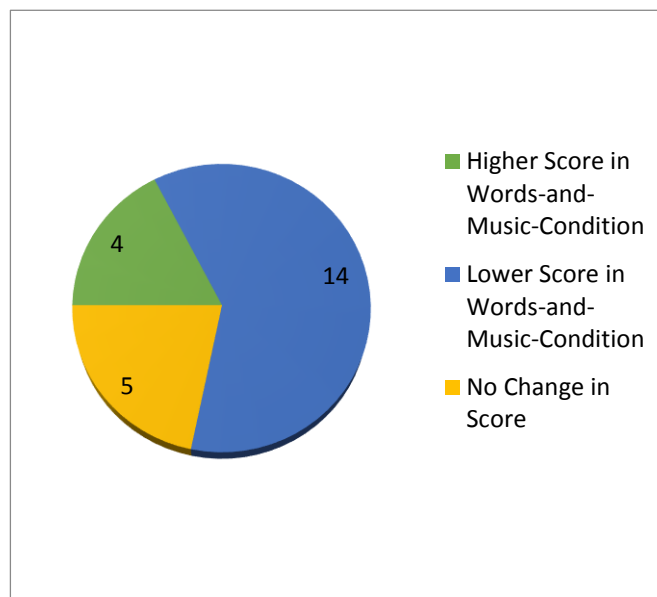


Figure 6.25 KS2 group: scores for verbal recall across conditions, recall phase n=23

6.3.8.6

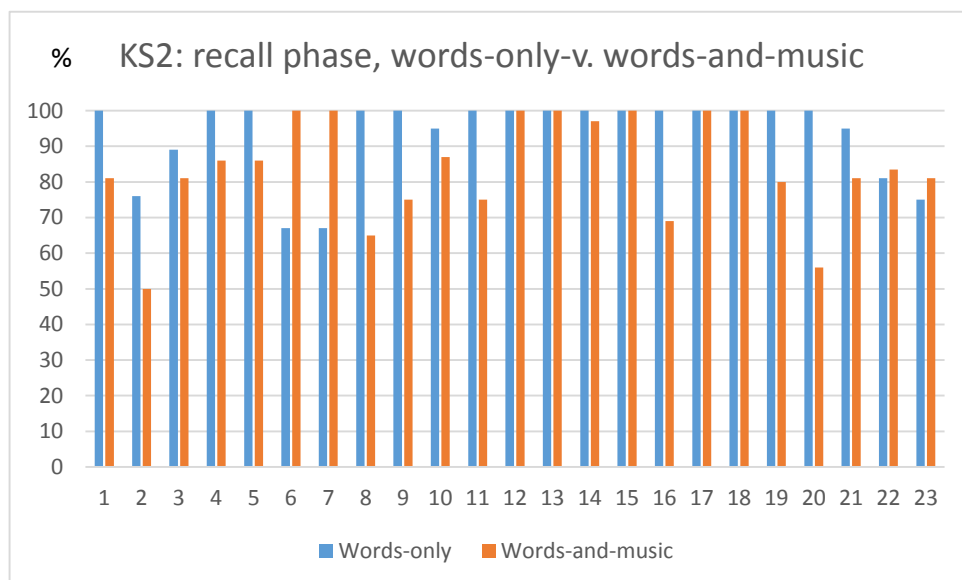


Figure 6.26 KS2 group: scores for verbal recall, recall phase n =23

6.3.8.7 For the 23 participants within the KS2 cohort, comparing verbal recall scores from the words-only condition to the words-and-music condition, scores were higher for four participants. For five participants (all of whom scored 100% in the words-only condition), scores remained the same. For fourteen participants, scores for verbal recall were lower in the words-and-music condition.

6.3.8.8 With regard to scores obtained for music recall in the recall phase, five children scored 0% for music recall in both the music-only condition and the music-and-words condition. For nine participants, scores obtained for music recall were higher in the music-only condition than the music-and-words condition, and for the remaining ten children scores were higher in the music-and words condition than the music-only condition.

6.3.9 In this section we consider the music scores obtained in the recall phase by the ASC group.

6.3.9.1

Participant	Music Score Music-only	Music Score Music-and-Words
1	70.5	31.5
2	100	97
3	0	0
4	0	0
5	0	0
6	84	63.5
7	35	57
8	0	0
9	0	0
10	0	42
11	0	19
12	39.5	83
13	25.5	12
14	65	0
15	56	43.5
16	92.5	72
17	35.5	38
18	31.5	60
19	43.5	72
20	46.5	63
21	73	89
22	35	25.5
23	57	43.5
24	57	66

Table 6.22 Melodic recall score for ASC group, recall phase N=24

6.3.9.2

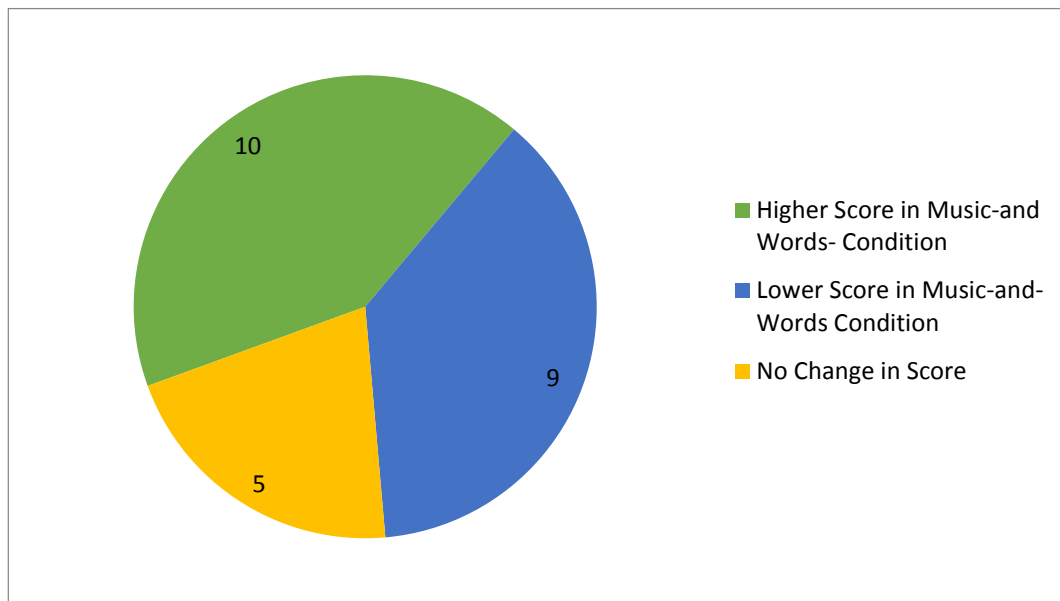


Figure 6.27 ASC group: scores for melodic recall across conditions, recall phase N=24

6.3.9.3

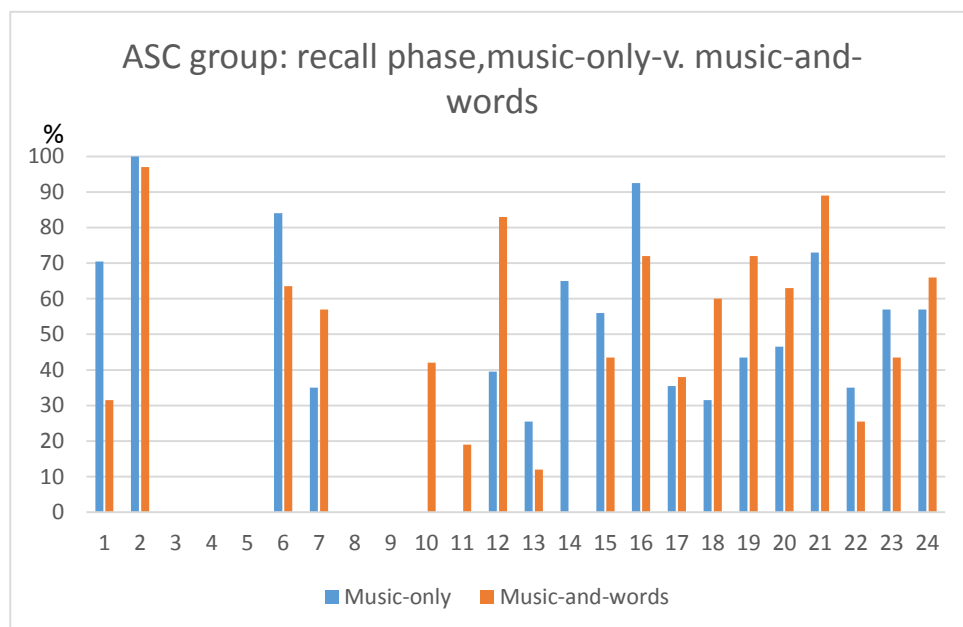


Figure 6.28 ASC group: Scores for melodic recall, recall phase N=24

6.3.9.4 One pattern to emerge is that, for those children who were less able to recall the melody, the presence of words had a positive effect, whereas for those children who were able to recall the melody more accurately, the presence of words had a negative effect.

6.3.9.5

	N (Participants)	Minimum %	Maximum %	Mean %	Std. Deviation
Music-only	24	0	100	39	31.9
Words-and-music	24	0	97	41	31.7
Pitch Music Only	24	0	100	34	30.5
Pitch Words Music	24	0	94	33	29.9
Rhythm Words Only	24	0	100	46	35.2
Rhythm Words Music	24	0	100	49	35.2

Table 6.23 ASC group: melodic recall scores: recall phase N=24

6.3.10 In this section we consider the music scores obtained in the recall phase by the comparison group.

6.3.10.1

Participant	Music Score Music-only	Music Score Music-and-Words
1	80	89
2	49	28.5
3	46.5	54
4	60	60.5
5	57	48.5
6	47	50
7	67.5	94.5
8	62.5	46
9	51.5	71.5
10	76	88.5
11	76	63
12	63	75
13	94.5	97
14	67.5	78
15	70.1	89
16	62.5	34
17	86.5	72
18	73	97
19	57	80
20	68	40.5
21	75.5	69.5
22	27.5	77
23	65	75
24	43	97.5
25	67.5	61
26	44	86
27	3	54
28	54.5	70.5
29	49.5	44.5
30	70.5	79
31	35.5	35.5
32	70.5	70.5

Table 6.24 Comparison group melodic recall, recall phase N=32

6.3.10.2

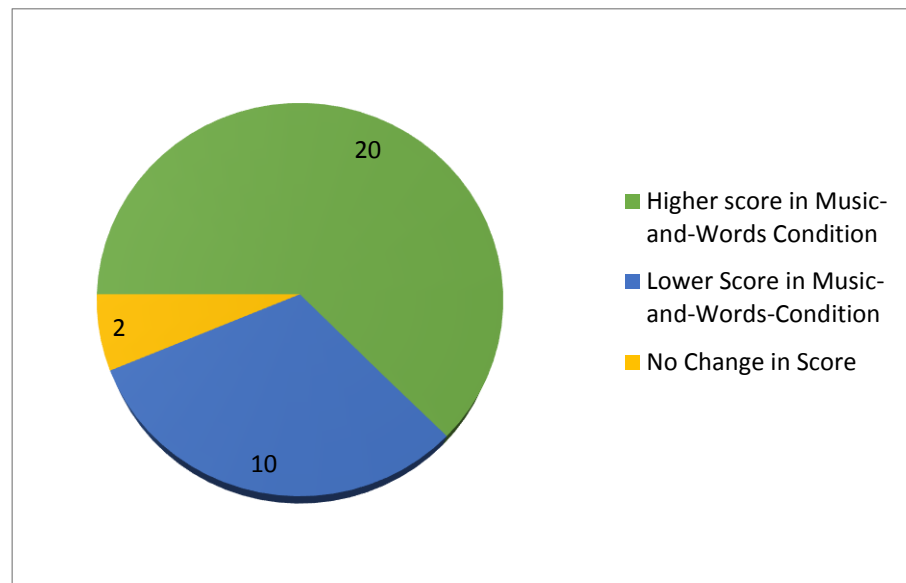


Figure 6.29 Comparison group: scores for melodic recall across conditions, recall phase N=32

6.3.10.3

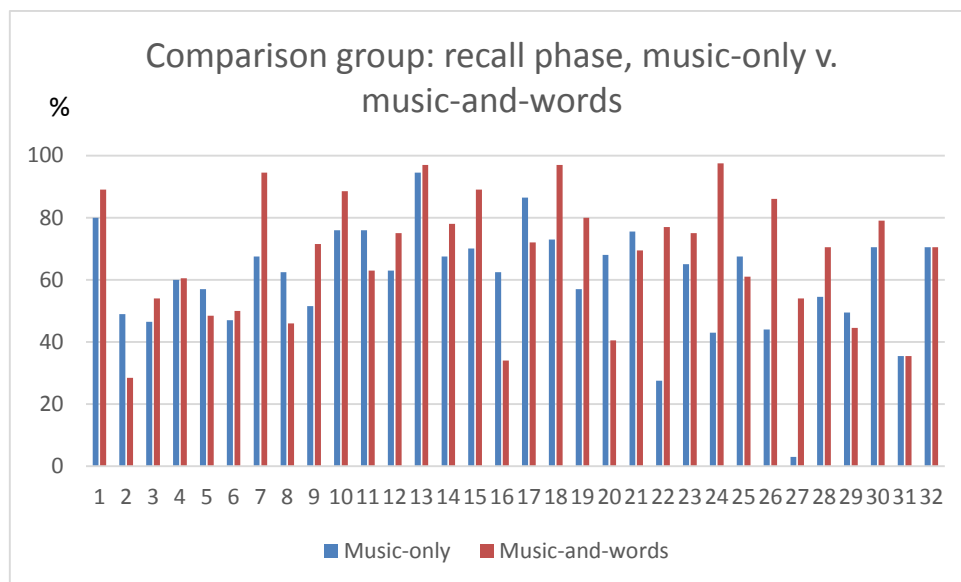


Figure 6.30 Comparison group: scores for melodic recall, recall phase N=32

6.3.10.4

	N (Participants)	Minimum %	Maximum %	Mean %	Std. Deviation
Music-only	32	3	95	60	17.9
Words-and-music	32	29	98	68	19.9
Pitch Music Only	32	0	95	48	22.4
Pitch Words Music	32	0	95	55	18.9
Rhythm Words Only	32	6	100	72	25.2
Rhythm Words Music	32	24	100	80	20.5

Table 6.25 Comparison group: melodic recall scores: learning phase N =32

6.3.10.5 Words had a beneficial effect on music recall with regard to both pitch and rhythm.

In terms of the pitch scores obtained, in the music-only condition the mean score obtained was 48%, while in the words-and-music condition it was 55%. With regard to rhythm, the score obtained in the music-only condition was 72%, while in the words-and-music condition it was 80%.

6.3.10.6 In both the music-only condition and the words-and-music condition, the scores obtained for music recall with regard to rhythm were considerably higher than scores obtained with regard to pitch. The results therefore provide evidence to suggest that, with regard to musical recall, neurotypically developing children find it easier to recall rhythms than pitch patterns.

6.3.11 On the next page I present the difference between children at KS1 and KS2 in long term melodic recall.

6.3.11.1

Participant	Music Score% Music-only	Music Score% Music-and-Words
1	27.5	77
2	65	75
3	43	97.5
4	67.5	61
5	44	86
6	3	54
7	54.5	70.5
8	49.5	44.5
9	35.5	35.5

Table 6.26 KS1 group melodic recall, recall phase n=9

6.3.11.2 With regard to scores obtained for music recall, comparing mean scores across conditions, it appears that the presence of words had a beneficial effect for children at KS1.

6.3.11.3

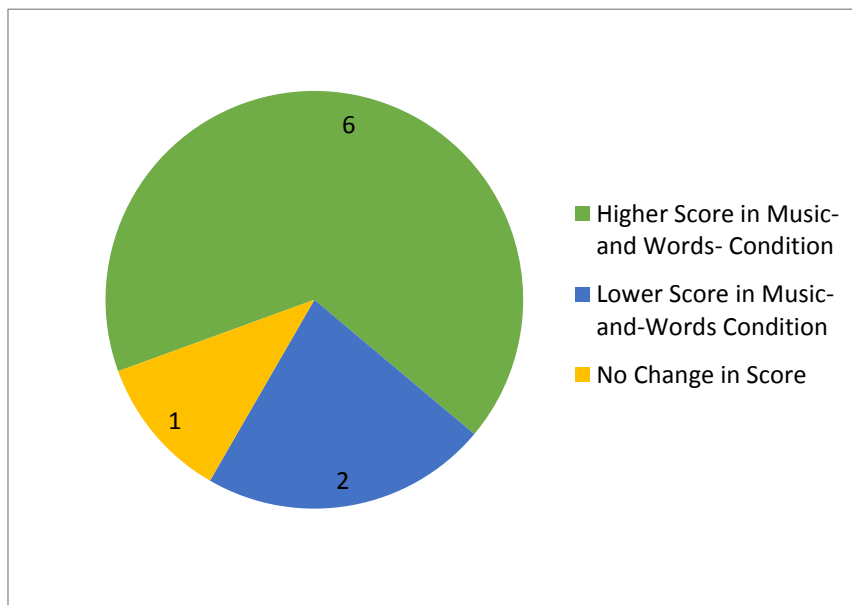


Figure 6.31 KS1 group: scores for melodic recall across conditions, recall phase n=9

6.3.11.4

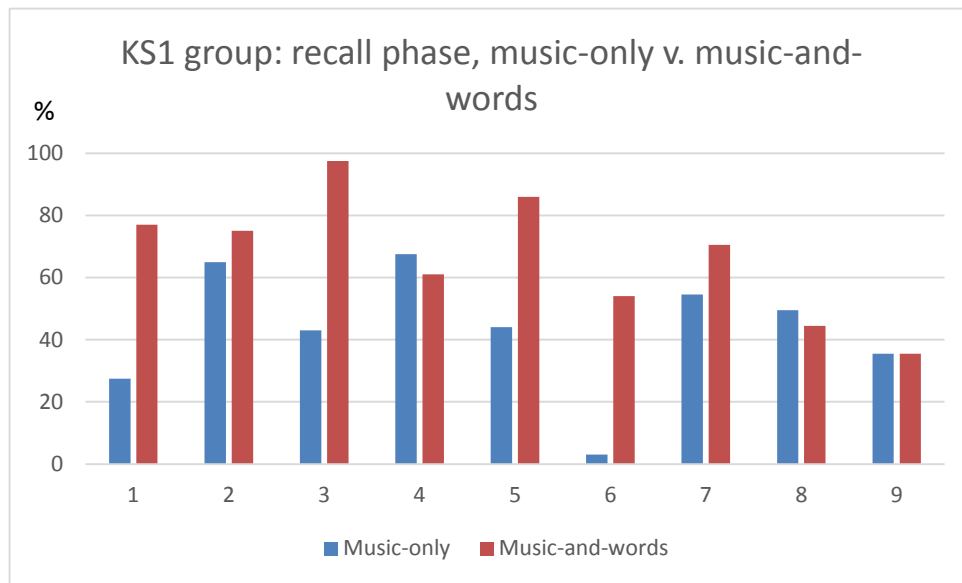


Figure 6.32 KS1 group: scores for melodic recall: recall phase n=9

6.3.11.5 For six participants, music scores were higher in the music-and-words condition than in the music-only condition. For two participants, scores were lower, and for one participant, scores were the same across conditions.

6.3.11.6

Participant	Music Score Music-only	Music Score Music-and-Words
1	80	89
2	49	28.5
3	46.5	54
4	60	60.5
5	57	48.5
6	47	50
7	67.5	94.5
8	62.5	46
9	51.5	71.5
10	76	88.5
11	76	63
12	63	75
13	94.5	97
14	67.5	78
15	70	89
16	62.5	34
17	86.5	72
18	73	97
19	57	80
20	68	40.5
21	75.5	69.5
22	70.5	79
23	70.5	70.5

Table 6.27 KS2 melodic recall, recall phase n=23

6.3.11.7

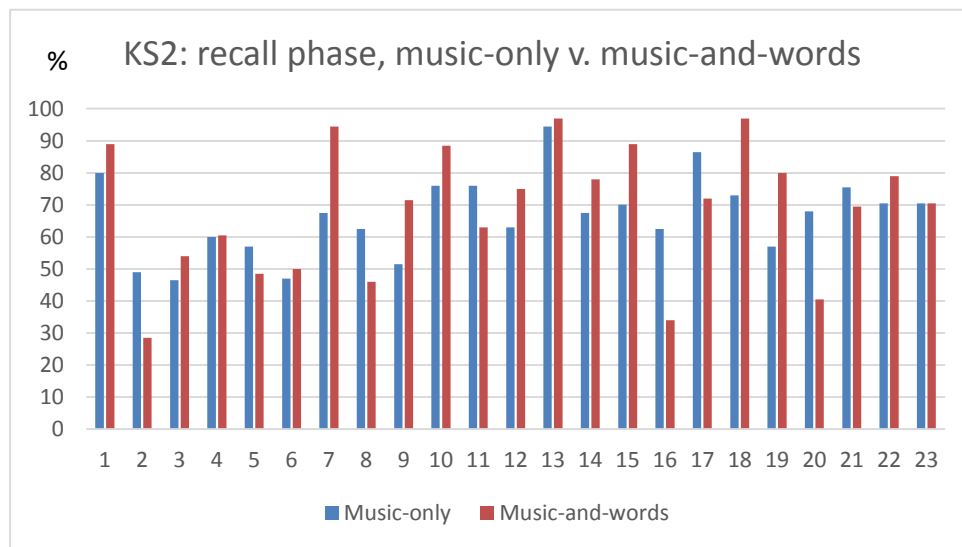


Figure 6.33 KS2: scores for melodic recall, recall phase n=23

6.3.11.8

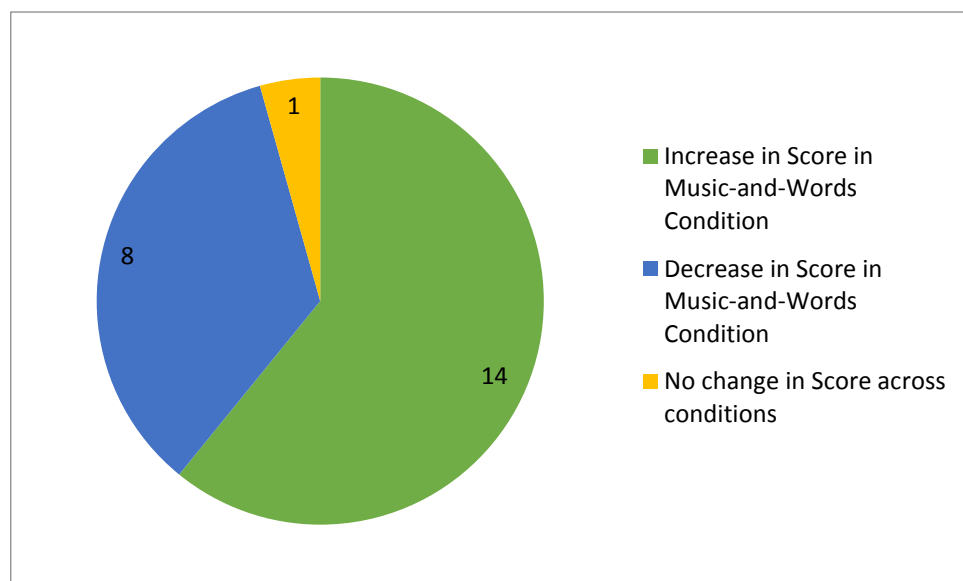


Figure 6.34 KS2: scores for melodic recall across conditions, recall phase n=23

6.3.11.9 The results show that, for KS2 participants, the effect of the presence of language on musical recall was varied. For fourteen participants scores were higher in the music-and-words condition than in the music-only condition, for eight participants the scores were lower, and for one participant, scores remained the same across conditions. However, the fact that the mean scores for musical recall across the two conditions for participants of the KS2 group – 67% in the music-only condition, and 68% in the music-and-words condition – were virtually identical suggests that, for KS2 children, the effect of the presence of language on musical recall in the long term was inconsequential.

6.4 Discussion

6.4.1 In this section, findings from the empirical study are analysed. We start with the analysis of scores obtained for both language and music by the ASC group and the comparison group in the learning phase, followed by analysis of data from the recall phase. Implications of these findings are further discussed in the general discussion chapter, where the findings are contextualised with regard to how they relate to similar research carried out on the relationship between music and language for children with ASC, and how the findings answer the central hypothesis and the research questions.

6.4.2 Learning phase: ASC group: words-only v. words-and-music language scores

The mean score obtained for verbal recall in both the words-only condition and the words-and-music condition was 72%. With regard to individual differences in scores across conditions, results showed that, for 10 participants, the presence of music

enhanced verbal recall, and for nine participants the presence of music had a deleterious effect. For five participants the presence of music had no effect. Thus, it was not possible to generalise the effect of music on language for children with ASC.

6.4.3 One pattern to emerge however, was that, for children with high verbal recall scores (over 90%), the presence of music was more likely to have a negative effect on verbal recall, while for children scoring under 50% music was more likely to have a positive effect. Six participants scored over 90% in the words-only condition and scores for all six participants were lower in the words-and-music condition. Conversely, six participants scored under 50% in the words-only condition and, for five of these participants, scores were higher in the words-and-music condition.

6.4.4 This suggests that the presence of music may have a beneficial effect for participants with ASC with limited linguistic ability, but as the level of linguistic ability increases, the beneficial effect of music on verbal recall decreases.

6.4.5 **Learning phase: Comparison group: words-only v. words-and-music**

Within the comparison group, 22 members obtained a verbal recall score of 100% in both the words-only condition and the words-and-music condition. For five children, scores were higher in the words-and-music condition and, for the remaining five, scores were lower. This fluctuation in scores between conditions was slight, however, and within a range of 6%.

6.4.6 **Learning phase: ASC group: music-only v. music-and-words**

The mean score obtained in the music-only condition for the ASC group in the learning phase was 49%, and it was slightly higher (51%) in the words-and-music condition. Concerning the group as a whole, the effect of the presence of language on the recall of melody was thus inconsequential. One pattern to emerge however, was that participants who obtained the lowest scores in the music-only condition saw the biggest difference in their scores with regard to melodic recall in the music-and-words condition.

6.4.7 With regard to the eight participants who obtained scores of under 30% in the music-only condition, six of them recorded higher scores in the music-and-words condition. For one participant, the score was lower by just 0.5%, and one participant scored 0% across both conditions. Thus, we can surmise that the impact of language on music may be proportional to the level of ability to recall melody in that, for children who were less able to recall melody, the presence of language may have a stronger enhancing effect.

6.4.8 **Learning phase: comparison group: music-only v. music-and-words**

For children at the level of KS1, the presence of language had no discernible effect on the recall of melody, although for children at KS2, the presence of language had an enhancing effect. This suggests that, for neurotypical children, the higher the level of verbal recall, the lower the beneficial effect of music on verbal recall.

Having analysed scores for language and music obtained by the ASC group and the comparison group in the learning phase, we now turn to the recall phase. We start

with the analysis of scores obtained for both language and music by the ASC group, followed by an analysis of the scores obtained by the comparison group.

6.4.9 Recall phase: ASC group: words-only v. words-and-music

The results from comparing language scores from the recall phase in the words-only condition versus the words-and-music condition showed that, for 15 out of 24 participants, language scores were higher in the words-and-music condition than in the words-only condition.

6.4.10 For six participants who scored between 6% and 31% (see fig. 5:35below) for verbal recall in the words-only condition in the recall phase, scores were higher in the words-and-music condition than in the words-only condition. However, when comparing the scores obtained by this cohort in the learning phase, three participants scored 100% in the words-only condition, yet in the words-and-music condition, the presence of music apparently served as a distraction, as scores for verbal recall were lower for these children.

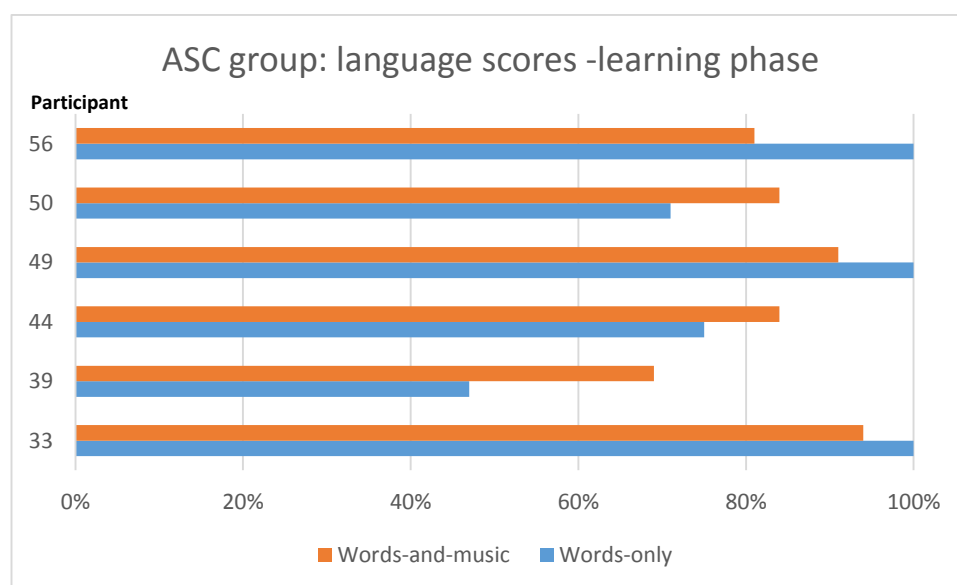


Figure 6.35 ASC group: verbal recall scores, learning phase N=24

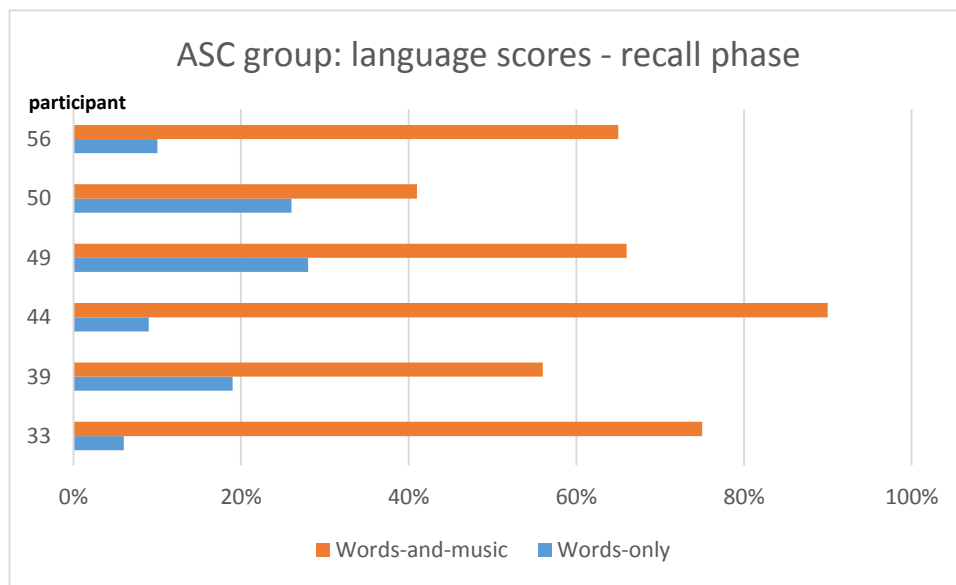


Figure 6.36 ASC group: verbal recall score, recall phase N=24

6.4.11 It would appear that if a child can recall a verbal phrase perfectly, seemingly the need for music is redundant, yet when the verbal material to be recalled is not as easily accessible, the presence of music can serve as a mnemonic. I would therefore argue that the impact music will have on verbal recall for children with ASC is related to a child's linguistic ability, and that the more sophisticated the linguistic skills, the less of an impact the presence of music will have on enhancing verbal recall. This could have important implications for ASC pedagogy, in that it appears that the beneficial effect of music on verbal recall seems to be more effective for children with limited verbal recall abilities in *both* the short term *and* the long term.

6.4.12 A total of 11 participants scored 0% in the words-only condition. With regard to these participants, five also scored 0% in the words-and-music condition, and for the remaining six participants, scores were higher in the words-and-music condition. One question to arise is this: why might the presence of music enhance language

scores for some of this cohort but not for the others? To help answer this question, scores obtained in the recall phase were compared to scores obtained in the learning phase.

Participant	Words-only learning	Words-and-music learning	Words-only recall	Words-and-music recall
35	43%	44%	0%	0%
36	44%	25%	0%	0%
37	44%	94%	0%	0%
40	56%	37%	0%	0%
43	0%	0%	0%	0%
38	88%	100%	0%	94%
41	13%	42%	0%	31%
42	100%	76%	0%	56%
45	53%	44%	0%	25%
47	73%	75%	0%	47%
54	48%	62%	0%	6%

Table 6.28 ASC group verbal recall scores across conditions for participants scoring 0% in the words-only condition in the recall phase n=11

6.4.13 With regard to the five participants who scored 0% in both the words-only condition, and the words-and-music condition, in the learning phase one participant still scored 0% in both conditions. With regard to the remaining four participants scores in the words-only condition ranged from 43% to 56%, and in the words-and-music condition, from 25% to 94 %. However, the effect of the presence of music on verbal recall in the learning phase was varied in that, for two participants scores for language were higher if participants had to sing as opposed to speak, yet for the other two, language scores were lower.

6.4.14 Concerning the remaining six participants who scored 0% for language in the words-only condition but had a higher language score in the words-and-music condition, in the learning phase language scores ranged from 13% to 100% in the words-only

condition and from 42% to 100% in the words-and-music condition. Again, in the learning phase the effects of music on language were diverse in that, for this cohort, for two participants, language scores were lower in the words-and-music condition, and for the other four participants, scores for language were higher.

- 6.4.15 Although, from comparing scores across conditions, no distinct patterns emerged *between* these two groups, for both groups, scores obtained for language were considerably higher in the learning phase, and we can thus state with some confidence that these data indicate that, for this group of children verbal recall was relatively intact in the short term but somewhat impaired in the long term.

6.4.16 **Recall phase: ASC group: music-only v. music-and-words**

The effect of language on music was diverse in that 10 participants obtained a higher score in the music-and-words condition, as opposed to nine participants who obtained a lower score in the music-and-words condition. Five participants scored 0% in both conditions. Note, however, that all participants achieved some success in at least one condition in the learning phase.

Participant	Music-only learning	Music-and-words learning	Music-only recall	Music-and-words recall
35	0%	26%	0%	0%
36	23%	23%	0%	0%
37	5%	83%	0%	0%
40	5%	46%	0%	0%
41	30%	40%	0%	0%

Table 6.29 ASC group: melodic recall scores across conditions for participants scoring 0% in the music-only condition in the recall phase n=5

6.4.17 Furthermore, for four of these five participants, scores for melodic recall were higher in the learning phase in the presence of words. Thus, in the short term, the presence of words enhanced melodic recall for this cohort.

6.4.18 A pattern emerged whereby, for participants with a higher level of melodic recall the presence of language was likely to have a negative effect on melodic recall, whereas for participants with a lower level in melodic recall, language had a positive effect on melodic recall. For the six participants scoring over 65% in the music-only condition, scores for melodic recall were lower in the words-and-music condition. Conversely, for those participants scoring below 45% – not including the participants who scored 0% in both conditions – for six participants, scores for melodic recall were higher in the words-and-music condition, and for two participants, scores were lower.

6.4.19 **Recall Phase: comparison group: words-only v. words-and-music**

The mean score for verbal recall obtained by the comparison group in the words-only condition was 83% as opposed to 84% in the words-and-music condition. Thus, there was effectively no difference between the two conditions. When the comparison group was split into children at KS1 and KS2, for the KS1 group, comparing mean scores across conditions, results show that the presence of words

had a beneficial effect. The mean score obtained for verbal recall was 56% in the words-only condition and 84% in the words-and-music condition. Conversely, for the KS2 group, the mean score obtained in the words-only condition was 93% as opposed to 84% in the words-and-music condition, suggesting that for the KS2 participants within the comparison group, the presence of music had a *detrimental* effect on the recall of language.

6.4.20 One reason for this, judging by the children's expressions and body language in the videos, was thought to be external, in that such children felt embarrassed to sing a song they considered inappropriate for their age.

6.4.21 These findings again support my belief that when linguistic skills are less developed the impact of music on verbal recall will be more pronounced. The level of linguistic abilities of typically developing children at the KS2 stage are more likely to be superior to the linguistic abilities of children at the level of KS1 and, as the data show, when linguistic abilities become more sophisticated, the impact of music on enhancing verbal recall starts to diminish.

6.4.22 **Recall Phase: comparison group: music-only v. music-and-words**

The results indicate that, for the comparison group, the presence of words had a beneficial effect on musical recall. The mean score in the music-only condition was 60% and this increased to 68% in the music-and-words condition. This indicates that the participants in the comparison group found it easier to recall the melody from a song as opposed to the melody from a non-verbal piece of music.

- 6.4.23 The results from the comparison group were split into KS1 and KS2, for the participants in KS1, with regard to scores obtained for music recall, comparing mean scores across conditions, the mean in the music-only condition was 43% as opposed to 67% in the words-and-music condition. Thus, there is evidence that the presence of words had a beneficial effect for these participants. Conversely, for the participants in the KS2 cohort, the mean score of 67% obtained in the music-only condition increased to just 68% in the music-and-words condition.
- 6.4.24 Looking at the scores obtained in the learning phase, this trend was reversed in that for the children at the level of KS1, there was *no* significant difference between the music-only condition and the music-and-words condition; yet, for the participants at the KS2 stage, scores for melodic recall were significantly higher in the music-and-words condition, when compared to the music-only condition.
- 6.4.25 It is not clear why words may enhance melodic recall in the short term for children at the level of KS2, but not at the level of KS1, and conversely, in the long term, words may enhance melodic recall for children at the KS1 stage but not children at the KS2 stage. Again, this finding may just be a consequence of the small sample.

Participants who recalled material from words-and-music condition as opposed to material from the words-only condition

ASC Group

6.4.26 Of all the participants in the experimental group who were exposed to the words-and-music condition *before* the words-only condition, seven when asked to recall the words from the words-only session, actually sang the words from the words-and-music session. This finding was of interest as participants would have heard material from the words-and-music condition either three or five weeks previously, as opposed to material from the words-only condition that they would have heard only one week previously.

6.4.27 The scores for these seven participants with regard to verbal recall in the words-only condition and the words-and-music condition were as follows:

Participant	Age	Words Only %	Words-and-Music%
41	9	0	31
47	8	0	47
38	9	0	94
44	11	9	90.5
49	16	28	66
34	10	81	94
48	13	87.5	87

Table 6.30 Participants in the ASC group recalling material from the words-and-music condition over material from the words-only condition n=7

Participants who recalled words-and-music as opposed to words-only

ASC Group

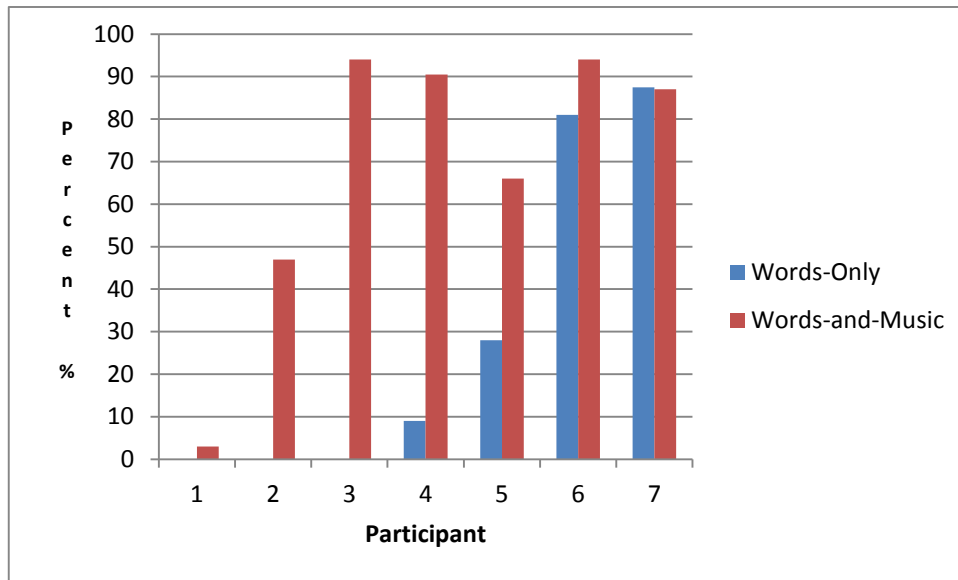


Figure 6.37 Participants who recalled words-and-music as opposed to words-only
ASC Group n=7

6.4.28 For participant 48 there was only a 0.5 % difference between the scores for verbal recall across the conditions. For the other six participants, scores obtained for verbal recall were higher in the words-and-music condition.

6.4.29 Seven participants were exposed to the words-only condition *before* the words-and-music condition. Added to this, five participants who were exposed initially to the words-and-music condition were unable to recall anything from either the words-and music condition, or the words-only condition. Therefore, a total of 12 participants could recall at least something in either condition; thus, in essence, 58% of *all* the participants with ASC who made at least some correct responses, recalled words and music from either three or five weeks previously, rather than prose they had heard just one week previously.

Comparison Group

6.4.30 Of all the participants in the comparison group who undertook the words and music condition *before* the words-only condition, five participants, when asked to recall the words from the words-only session, actually sang the words from the words-and-music session, which they would have heard three or five weeks previously, as opposed to reciting the prose they had heard only one week previously. All five participants were at KS1.

6.4.31 The scores for these five participants with regard to verbal recall in the words-only condition and the words-and-music condition were as follows:

Participant	Age	Words Only %	Words-and-Music%
23	5	53	83.5
24	5	53	90.5
25	5	47	83
31	7	75	81
28	5	81	100

Table 6.31 Participants recalling material from the words-and-music condition over material from the words-only condition n=5

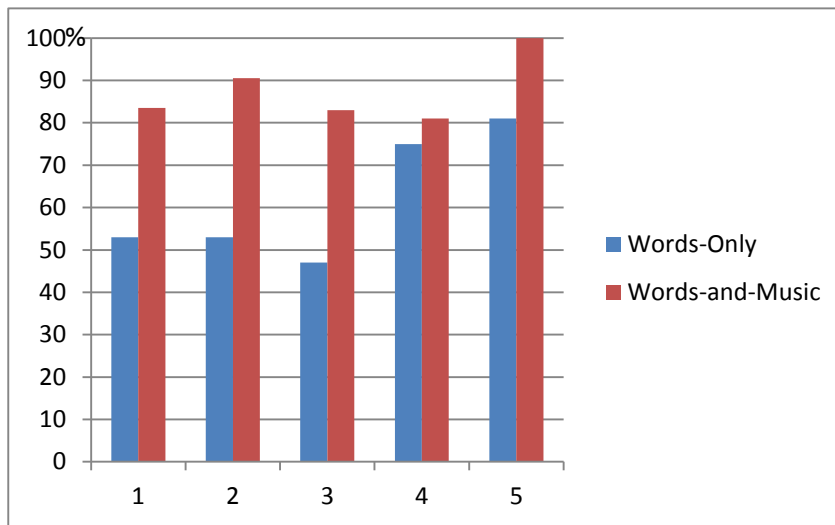


Figure 6.38 Participants who recalled words-and-music as opposed to words-only n=5

6.4.32 For all the participants in the comparison group who underwent the words-and-music condition before the words-only condition, of a total of 11 participants, 5 (45%) recalled material from the words-and music condition from 3 or 5 weeks previously rather than material from the words-only condition that they had heard just one week before. With regard to research question 4, ‘What is the effect of music on language for neurotypically developing children,’ these findings would suggest that, for children at KS1, singing as opposed to speaking has a positive effect on verbal recall.

Participants who recalled material from the words-only condition as opposed to the words-and-music condition.

ASC Group

6.4.33 A total of eight participants in the ASC group were exposed to the words-and-music condition *before* the words only condition. Just one participant from the ASC group exclusively recalled material from the words-only condition in week 1 of the study when asked to recall material from the words-and-music condition in week 4 of the study.

Comparison Group

6.4.34 In total 21 participants from the comparison group who were exposed to the words-only condition in advance of the words-and-music condition. Of these participants, just one participant made any reference to the words-only condition when asked to recall material from the words-and-music condition. In sum, in both the ASC group and the comparison group, the number of times participants recalled material from the words-and-music condition when they had been exposed to this before the words-only condition far outweighed the number of times participants recalled materials from the words-only condition when this phase preceded the words-and-music condition. This suggests that the combination of words-and-music was more likely to be held in the long-term memory than words alone for both participants with ASC and their neurotypically developing peers at the level of KS1.

6:5 Concluding remarks

6.5.1 The main findings to emerge from the empirical phase of this study, in relation to the sample, were as follows:

- With regard to recall in both the short term and the long term, the presence of music had a beneficial effect for participants with ASC with limited linguistic ability, but the higher the level of linguistic ability, the lower the beneficial effect of music on verbal recall.
- With regard to recall in the short term and the long term, for children with ASC with lower levels of musical development the presence of words had a positive effect on melodic recall, although for those with more highly developed musical skills, the beneficial effect of the presence of words on melodic recall was lower.
- Concerning recall in the long term, music enhanced verbal recall for ‘typically developing’ children who are at KS1.
- Concerning recall in the long term, the presence of music had a negative effect on verbal recall for the typically developing children at KS2.
- With regard to recall in the short term, the co-existence of a string of words with melody made the melody easier to learn for the typically developing children at the level of KS2. There was no such effect for children at KS1.
- With regard to recall in the long term, the co-existence of a string of words with melody made the melody easier to learn for the neurotypical children at KS1. There was no such effect for children at KS2.
- With regard to short term and long term recall, both children with ASC and typically developing children were more successful in remembering rhythm than melody.

7: General Discussion

7.1 Introduction

7.1.1 In this section we reconsider the main hypotheses and contextualise the findings of both the questionnaire and the comparative intervention in relation to the literature. Limitations with regard to the design of the research are discussed, the implications for practice are considered, and recommendations are made for future research.

7.1.2 At the outset, my hypotheses were that:

- 1) the co-existence of music and words may facilitate language and music learning and utilisation for children with ASC; and
- 2) this effect will be more marked for children with ASC than for those developing neurotypically.

My research questions were:

- 1) Does the co-existence of melody with a string of words make the words easier to learn and reproduce for children with ASC?
- 2) Does the co-existence of melody with a string of words make the words easier to learn and reproduce for ‘typically developing’ children?
- 3) Does the co-existence of melody with a string of words make the music easier to learn and reproduce for children with ASC?
- 4) Does the co-existence of melody with a string of words make the music easier to learn and reproduce for ‘typically developing’ children?

7.2 Findings from the interviews, questionnaire and the empirical study

7.2.1 To recap, the main finding from chapter 4 based on the responses from semi-structured interviews carried out with parents, teachers, carers and music therapists was that children with ASC sing. Furthermore, involvement in music was found to enhance relationships for children with ASC, and that for these children, words learnt from song can cross over into real-life situations.

7.2.2 To recap the main findings from chapter 5, according to the respondents of a questionnaire for the parents and teachers of children on the autism spectrum (N=320):

- Around nine out of ten children on the autism spectrum with little language, who use only single words or two-word sentences, nonetheless sing.
- Around a quarter of children with ASC who are described as ‘non-verbal’ sing.
- Music was reported to enhance relationships for around 2/3 of the children with ASC.
- Music was reported to be of greater value in enhancing relationships for children with ASC with little or no speech than for those whose language was unimpaired.
- Words learnt from songs were more likely to be used in real life-situations by children with some language delay, compared to children whose language was unimpaired.
- Parents tended to rate their children’s singing and language abilities higher than did the teachers.

- Around a quarter of parents believed their children had absolute pitch, while only 3% of teachers believed as much.

7.2.3 The main findings from the comparative intervention (chapter 6), in relation to the samples N=24 (children on the autism spectrum) and N = 32 (children developing ‘neurotypically’) were as follows:

- With regard to recall both in the short term and the long term, the presence of music had a beneficial effect for participants with ASC with limited linguistic ability, but the higher the level of linguistic ability, the lower the beneficial effect of music on verbal recall.
- With regard to recall in the short term and the long term, for children with ASC with lower levels of musical ability the presence of words had a positive effect on melodic recall, although for those with more highly developed musical skills, the beneficial effect of the presence of words on melodic recall was lower.
- Concerning recall in the long term, music enhanced verbal recall for the typically developing children who are at KS1.
- Concerning recall in the long term, the presence of music had a negative effect on verbal recall for the typically developing children at KS2.
- With regard to recall in the short term, the co-existence of a string of words with melody made the melody easier to learn for the typically developing children at KS2. There was no such effect for children at KS1.

- With regard to recall in the long term, the co-existence of a string of words with melody made the melody easier to remember for the typically developing children at KS1. There was no such effect for children at KS2.
- With regard to short term and long term recall, both children with ASC and typically developing children were more successful in remembering rhythm than melody.

7.2.4 With regard to the first observation - that the words children with ASC learn from songs cross over into everyday activities - in the questionnaire, respondents reported that this is the case for 35% of children on the autism spectrum (see Figure 5.10). However, it was reported that words learnt from songs cross over into everyday activities for 43% of children with some language delay, compared to just 12% of non-verbal children and 35% of children who speak at the appropriate level (see Figure 5.14).

7.2.5 This initially suggests that, for children who were reported to have some language delay, the potentially beneficial effects of music on language are more powerful. However, the question remains: How can 12% of non-verbal children use words from song in everyday life? How can words learnt from song cross over for these children? It could be that respondents interpreted the question 'Have you noticed any instances where your child has learnt a word in a song and applied that word in a real-life situation?' as encompassing a child's ability to recognise words learnt through song as opposed to using a word learnt from a song as part of expressive speech.

- 7.2.6 With regard to the second observation – that involvement in musical activities enhances social relationships for children with ASC – it was reported that music enhanced relationships for around two thirds of the children (see Figure 5.13). This finding is congruent with research carried out by Wimpory and Nash (1999), who showed how, in a single case-study, a participant would initiate just 20% of interactions with her mother before interactive music therapy sessions, which subsequently increased to 75% over the course of 16 months’ intervention (see 2.5.2.8).
- 7.2.7 This finding is also compatible with the evidence of Edgerton (1994), who in her study attempting to ascertain the efficacy of improvisational music therapy on communication for 11 children with ASC, showed that the intervention was effective in both eliciting and increasing communicative behaviours (see 2.5.2.4). Edgerton, in noting that activities involving responding to a change in musical tempo may impact positively on communication, believed that this may arise because of the ‘fundamentally rhythmic behaviours of autistic children’ (1994: p.55). She described how ‘the subjects in the present study were able to synchronise their drum beating with the ongoing music to varying degrees’ (1994: p.56), and, as previously mentioned in the review of literature, synchronisation of musical activities with the children’s repetitive movements may have created greater awareness and sense of control, which in turn would be a precursor to more efficacious communication. Additionally, the fact that children in the ASC group in both the learning phase and the test phase of the empirical study were more successful in recalling rhythm than melody further endorses this line of thought.

- 7.2.8 Buday (1995) showed that, in the presence of music, participants with ASC displayed significantly fewer autistic traits, including hand flapping, head movement and incomprehensible babbling (see 2.5.2.9). Buday believed that the presence of music reduced boredom for the children and as such, they were more motivated to communicate with others. That is, the presence of music may indirectly enhance relationships with others for children with ASC as it may put the children in a state of mind more conducive to communication. In my questionnaire, respondents reported that music enhanced relationships more for children who were at the one- or two-word utterance level than for children who were either non-verbal or, were considered to have age-appropriate speech.
- 7.2.9 With regard to research question 1, ‘Does the co-existence of melody with a string of words make the words easier to learn and reproduce for children with ASC?’, one of the main findings from the questionnaire was that around nine out of ten children on the autism spectrum with some language delay sing (see Figure 5.15). This complements findings from the comparative intervention whereby, with regard to recall in both the short term and the long term, the presence of music had a beneficial effect for participants with ASC with limited linguistic ability. However, the higher the level of linguistic ability, the less beneficial the effect of music on verbal recall. From this we can surmise that the co-existence of melody with a string of words enhances the learning and recall of language for children with ASC with limited linguistic ability; however, for those with more expressive language, the positive effect of singing decreases. Furthermore, for some children whose language development was within the usual range, music had a negative impact on learning a series of words.

- 7.2.10 In the learning phase of the comparative intervention, with regard to recall in the short term, 10 participants in the ASC group scored over 90% in the words-only condition. In the words-and-music condition, apart from the four children who were judged to have made no mistakes at all in either condition, scores for the remaining six participants were lower in the words-and-music condition. Conversely, five of the six participants who were judged to have scored under 50% in the words-only condition, performed more successfully in the words-and-music condition (see Table 6.7).
- 7.2.11 With regard to recall in the long term, the finding that six out of seven children in the ASC group scored between 6% and 28% for verbal recall in the words-only condition but subsequently performed better in the words-and-music condition, is in accordance with the findings from the questionnaire. According to respondents from the questionnaire, children with some language delay are more likely to sing than children who are non-verbal or children with age-appropriate language skills. Children scoring between 6% and 28% in the words-only condition did not have age-appropriate language skills, although they were also clearly not non-verbal as they could recall at least some of the words in the words-only condition. Arguably, this finding suggests that the presence of melody does in fact make words easier to learn and reproduce for children with ASC who have some language delay (see Table 6.16).
- 7.2.12 This finding also accords with evidence provided by Lim (2012: p.14). In her study, she employed a music technique called developmental speech and language training through music (DSLM), incorporating six original songs which included 36 target

words and phrases. Each line ended with a target word and phrase, and the study comprised a speech condition and a music condition, where the target words and phrases were either spoken or sung using guitar accompaniment.

When the participants were classified as high-functioning or low-functioning, the former improved their speech more than in either music or speech training.

Conversely, low-functioning participants showed a greater improvement after the music training than the speech training (see 2.5.2.11), and Lim claimed that as a result of this, they could ‘acquire and produce functional vocabulary words’ (2010: p. 189).

- 7.2.13 In the recall phase of my study, for 15 out of 24 participants in the ASC group, language scores were higher in the words-and-music condition, when compared to the words-only condition (Figure 6.20). This finding concurs with those of Nordoff and Robbins (1977), who showed that involvement in improvisational music therapy could enable ‘significant progress’ to be made with regard to verbal recall. The technique that they developed, which became known as ‘Creative Music Therapy’, incorporated the use of improvised music to reflect the motor, vocal and instrumental behaviours and responses of clients. In a single case-study, evidence showed how the intervention allowed the child to ‘demonstrate progress in increased vocabulary’ (1968:p.192). In a further single subject study, progress was reportedly made by one child in terms of ‘increased vocabulary, and development of spontaneous and communicative speech’ (1977: p.118).

- 7.2.14 The finding of my research also accords with Edgerton (1994: p.55), who wrote: ‘It has been stated that communication through music bypasses the speech and

language barriers of autistic people’ (see 2.5.2.5). Her study was carried out to determine the effectiveness of improvisational music therapy, on the communicative behaviours of eleven children on the autism spectrum, and it was based on Nordoff and Robbins’s (1977) Creative Music Therapy approach. The children, aged between six and nine years took part in individual music therapy sessions for a period of ten weeks. Results provided evidence for the ‘efficacy of improvisational music therapy in increasing autistic children’s communicative behaviors’ (Edgerton: 1994: p.31).

- 7.2.15 In the questionnaire study, one of the main findings was that respondents reported that over a quarter of children with ASC who were reported as non-verbal, actually sing. This suggests that some children with ASC prefer singing to speaking. From my experience of working at the Special School in Cornwall, some children there were described to me as being ‘non-verbal’, yet they were able to sing the words to simple Bob Marley songs, and could remember these words one week later. It is doubtful that the children understood the words they sang, and it may be that they were processing the words as a series of abstract sounds, i.e. as music. It is almost as though, for the children concerned, the words function as another strand in the musical texture – like a series of changing timbres. This could occur because of the ‘Exceptional Early Cognitive Environment’ as described by Ockelford (2013: p.242) where he asserts that there is a tendency among some children on the autism spectrum for many sounds (including linguistic ones) to be processed in musical terms (Ockelford: *op cit.* p.61).

7.2.16 It could be that initially, language and music are stored indivisibly in memory, and therefore words can only appear in the context of singing. Serafine, Crowder and Repp (1984) believed that the process of storing lyrics and melody is integrated (see 2.5.4.6). In their study, participants listened to a serial presentation of excerpts from largely unfamiliar folksongs, followed by a recognition test. The results confirmed that the advantage for recognising old songs over mismatched songs was highly significant across subjects, and across test items, and the researchers concluded that ‘these results suggest that the melody and text are integrated in memory to a considerable degree’ (1984: p.294).

7.2.17 A second explanation for why some children reported to be non-verbal sing may be that words can be learnt and stored separately from music, but the children do not feel confident enough to use them without the structure that music provides. Support for this comes from the evidence provided by Morrongiello and Roes (1990) that melody and text may be integrated to a lesser extent for children than for adults (see 2.5.4.11). In their study, completely different songs were judged as not at all the same by adults and children alike, although children were more likely to judge songs that retained just the words as ‘exactly the same’ and to judge songs that changed the words as ‘not at all the same’, even when the melody remained intact. This begs the question, is music stored independently or in an integrated way for some or all children on the autism spectrum who prefer to sing as opposed to speak?

7.2.18 In answer to this question, I contend that findings from my research in the comparative intervention suggest that, for children with limited linguistic ability,

melody and words are *integrated* in memory. In the words-and-music condition, verbal recall was higher when compared to the words-only condition. Furthermore, with regard to children with limited musical ability, melodic recall was also higher in the words-and-music condition when compared to the music-only condition. Something changes, however, in that, for children with ASC, as linguistic ability becomes more sophisticated, the impact of music on verbal recall decreases, and, in a similar vein, as musicality becomes more sophisticated, the enhancing impact of language on musical recall decreases.

7.2.19 On the surface, it would appear that, as musical and linguistic abilities become more sophisticated, the likelihood of children with ASC having the capacity to process both the words and the music of song independently increases, as one mode would appear to interfere with the other. This contradicts the findings of Morrongiello, who provided evidence to show that words and music are integrated to a lesser extent in children when compared to adults. In their study, however, children were asked to *recognise* songs, as opposed to recall and perform songs, and it could be that children may well employ one strategy for recognising a song and another for recalling and performing a song.

7.2.20 On the other hand, children in the early stages of language acquisition may process words as music. That is to say, a word is perceived phonetically, and there is no awareness of meaning. As the child's linguistic skills become more refined, words start to be processed semantically, and as the meaning of words are perceived and understood, words and music begin to be processed independently.

7.2.21 The finding that over a quarter of children with ASC reported to be non-verbal sing is further endorsed in the empirical study, in which six participants scored 0% in the words-only condition but between 6 % and 94% in the words-and-music condition (see Table 6.28). Although children who scored 0% in the words-only condition were not non-verbal (as they showed evidence of learning words in the words-only condition in the learning phase), arguably for some of these children, expressive language was a challenge with regard to recall in the long term.

7.2.22 This finding accords with the views of Sherwin (1953), who described how some children on the autism spectrum showed a preference for singing over speech (see 2.5.2.1). The finding also concurs with the opinion of Ockelford (2013: p.192), who wrote that,

‘since music and speech are in part processed differently in neurological terms, some children who are normally unable to speak, or who find verbalizing difficult, may never the less be able to communicate by singing words and phrases, or at least intoning them within a rhythmic structure.’

7.2.23 Finally, this finding supports the evidence provided by Kraus and Chandrasekaran (2010), who believed that the neural encoding of speech can be enhanced by non-linguistic auditory training which could also include musical training (see 2.5.3.5). They believed that musical training strengthens neural processes that are impaired in individuals with speech and language processing problems, through a process of increased adaptive plasticity. They reasoned that involvement in music influences adaptive plasticity in speech processing, because both music and speech use pitch, timing and timbre.

- 7.2.24 With regard to research question 2, ‘Does the co-existence of melody with a string of words make the words easier to learn and reproduce for ‘typically developing children?’’, there was no effect of music on verbal recall in the short term. In the learning phase, the score for the comparison group as a whole in both the words-only condition and the words-and-music condition was just under 100% (see Table 6.9).
- 7.2.25 Concerning recall in the long term, in the test phase, again taking the comparison group as a whole, there was just a 1% difference in scores for verbal recall across conditions (statistically insignificant). However when the group was split into children at KS1 and KS2, for the KS1 group the mean score for verbal recall was 56% in the words-only condition compared to 84% in the words-and-music condition (see Figure 6.24). This finding suggests that the co-existence of melody with a string of words *does* make the words easier to learn and reproduce for typically developing children at KS1. For children at the level of KS2, however, the music had a negative effect on verbal recall in that the mean score for verbal recall in the words-only condition was 93%, as opposed to 84% in the words-and-music condition (see Figure 6.25). These findings again suggest that when linguistic skills are less developed, the positive impact of music on verbal recall will be more evident.
- 7.2.26 It is not entirely clear why the presence of music had a negative effect on verbal recall for the children at KS2, although from the video evidence, it appeared that some of the children were embarrassed at having to sing a ‘children’s song’; thus,

the lower scores in verbal recall in the presence of music could have been due to this. Had the genre of music been different, or the words and music condition been presented in a different context, the results may have been different.

7.2.27 This finding is important as it highlights the need to be aware of how, for neurotypical children, the function of music may change between KS1 and KS2. The role of music, the way it is used in the curriculum, and its genre should take into account developmental differences between KS1 and KS2 to maximise the extent to which music might inform wider learning and development.

7.2.28 With regard to verbal recall in the short term, in the learning phase, the overall mean percentage obtained by the comparison group in the words-only condition was 99% (see Table 6.10) compared to 72% for the ASC group (see Table 6.8). The fact that scores for verbal recall in the short term for the ASC group were lower than scores obtained by the comparison group, supports the findings of Jones, Happé and Pickles (2011), who carried out a study to ascertain the difference between verbal recall in children with ASC, and those who were typically developing. They provided evidence that, in contrast to a comparison group of neurotypical individuals (N=55), performance in the Children's Auditory Verbal Learning Test – 2(CAVLT – 2) for a sample of children on the autism spectrum (N =94) was significantly impaired (see 2.2.3.11).

7.2.29 It was of interest to note that in the recall phase for the children with ASC the score of 39% obtained for melodic recall in the music-only condition (see Table 6.23) was higher than that for verbal recall in the words-only condition of 25% (see Table

6.17). In the learning phase the score for melodic recall in the music-only condition was lower, and this was also the case for the comparison group in both the learning phase and the test phase. This suggests that, with regard to long-term recall, some children with ASC are more successful at recalling melody than words.

7.2.30 This complements research carried out by Mottron, Peretz and Ménard (2000), who carried out a study to examine how individuals on the autism spectrum process music (see 2.5.5.2). The study involved 13 individuals with high functioning autism and a control group of 13 neurotypical individuals matched for age and IQ. Results showed that the individuals in the ASC group performed better than individuals in the control group at detecting change in a contour preserved melody. The researchers believed that this was because of a ‘local bias in music perception in individuals with autism’ (2000: p.1057). The finding in my research that, with regard to recall in the long term, the children in the ASC group managed to reproduce a melody in the music-only condition more successfully than words in the words-only condition, could also be explained because of a local bias in music perception.

7.2.31 My finding also accords with the evidence of Järvinen-Pasley et al. (2007). In their study, they tested processing biases in children with autism and matched controls, using linguistic stimuli with competing low-level/ perceptual and high-level /semantic information (see 2.5.5.8).

7.2.32 In the first experiment, 20 children on the autism spectrum and a control group of 20 neurotypical children matched for age, gender and intellectual ability were exposed to stimuli, comprising speech samples, and ‘perceptually analogous’ music samples. The researchers found that when the perceptual task was to process pitch contour information, there was no difference between the ASC group and the matched control. Conversely, when the perceptual task was to detect differences in temporal patterning, the control achieved ‘significantly higher levels of perceptual discrimination of semantically meaningless as compared to semantically meaningful stimulus’ (2007: p. 8). The researchers believed that this implied that children with autism have superior perceptual processing of speech when compared to age-matched controls and that, furthermore, ‘semantic-level processing is not the primary, or default, speech processing mode.’ (2007:p. 9).

7.2.33 Concerning research question 3, ‘Does the co-existence of melody with a string of words make the music easier to learn and reproduce for children with ASC?, vis-à-vis melodic recall in the short term (see Figure 6.12) and long term (see Figure 6.27), for children with ASC with less advanced musical development, the presence of words had an enhancing effect, although for those with more highly developed musical skills, the beneficial effect was smaller. This would again suggest that, initially, language and music are stored indivisibly in memory; thus, for those children with limited musical ability the presence of words enhanced melodic recall.

7.2.34 With regard to research question 4, ‘Does the co-existence of melody with a string of words make the music easier to learn and reproduce for ‘typically developing’ children?’, with regard to recall in the short term, in the learning phase the co-

existence of a string of words with melody made the melody easier to learn for the typically developing children at KS2 (see Figure 6.18). There was no such effect for children at KS1 (see Figure 6.16). In the recall phase, however, this trend was reversed in that, in the long term, the presence of language did have a positive effect on melodic recall for the children at KS1 (see Figure 6.32) and, conversely, there was no such effect evident for the KS2 children (see Figure 6.33). Such a finding suggests that, for children at KS2, music and words are more integrated with regard to short-term recall, but for children at KS1 music and words are more integrated with regard to recall in the long term. It is not clear why this should be so. It is possible that children have different memory strategies with regard to melodic recall in the short term and melodic recall in the long term, and these strategies change between KS1 and KS2, although further research is needed to confirm such a line of thought.

- 7.2.35 In both the preliminary study, and the questionnaire, parents and teachers differed in how they rated children's linguistic and musical abilities, in that parents tended to rate their children's singing and language abilities higher. For instance, 17% of parents described the level of their children's singing as more advanced than expected, as opposed to only 2% of teachers (see Figure 5.24). This has important implications for practice, in that better communication between parents and teachers could benefit children with ASC in terms of how involvement in music could augment communication skills. Parents may be more aware of the meaning and relevance of their children's idiosyncratic use of both speech and singing, or they may have been unduly positive about their children's abilities.

7.3 Limitations of this research

7.3.1 There were a number of limitations in both the questionnaire and the empirical study which need to be considered. Firstly, we consider constraints in the use of the questionnaire. Around 20% of participants responded to the first page of the questionnaire, which contained just two questions asking for the gender of the child and the nature of his or her special needs, but did not continue to the second page. This might have been avoided by ensuring that no page turn was involved so early on and including other questions on the first page, or, better still, avoiding any breaks between the questions at all.

7.3.2 The responses indicate that some of the questions may have been misinterpreted by respondents. With regard to questions concerning absolute pitch, the responses seem to indicate that around one in five children with ASC have absolute pitch; this figure is higher than the literature suggests. A brief explanation of absolute pitch was provided (see 5.2.6.8); however, from the responses collected, it would seem that the term ‘absolute pitch’ was sometimes misunderstood. A similar problem was encountered by Ockelford and Matawa (2009: p.26) in their examination of musical ability in children with retinopathy of prematurity. With regard to testing for absolute pitch,

‘It was an area where the researchers anticipated that it would be difficult to obtain reliable data from parents even when they had access to comments from music teachers, since testing a child for AP – particularly if he or she has learning difficulties, and who may therefore be unable to give appropriate verbal responses, is a specialised task.’

- 7.3.3 The researchers believed that their data pertaining to absolute pitch contained both false positives and false negatives. It is difficult to know how to counter this problem within the context of a questionnaire. As an alternative, instead of asking respondents whether children have absolute pitch, they might be asked whether children can name the pitch of the notes that they hear; this may avoid a scenario in which respondents state that their children have absolute pitch when what they actually mean is that their children can sing in tune. The problem with this, however, is that it could lead to false negatives, as it appears that many children with severe autism who possess AP do not know the names of the notes.
- 7.3.4 Respondents were asked to state the nature of their children's special needs, and it was reported that 80% of children were diagnosed with ASC and 20% had Asperger's syndrome (see Figure 5.2). With regard to levels of speech, however, 41% of children were reported to speak at the appropriate level (see Figure 5.3). This does not accord with the view (see for example Baron- Cohen, 2008: p.13) that there is language delay in autism but not in Asperger's syndrome. The finding in this study that 41% of all children were reported as having appropriate speech thus seems disproportionate and suggests that some children who would otherwise be described as having Asperger's syndrome may have been classified here as having ASC. However, since the questionnaire responses were collected, as mentioned in the review of literature (see 2.2.2.1), Asperger's syndrome has been taken out of the DSM - 5. For any individuals who have already been diagnosed with Asperger's syndrome, this will not change. Individuals who have not yet been diagnosed, who would have previously been diagnosed with Asperger's syndrome, are now given a diagnosis of ASC (National Autistic Society 2014).

7.3.5 Turning to the comparative intervention, one problem to emerge was the high attrition rate within the ASC sample. Although there were 64 participants at the start of the study, over the course of the six weeks more than 50% of the participants dropped out for various reasons that were beyond the control of the researcher. It was expected that some children would not complete the study, but the extent to which children dropped out was surprising; thus, with hindsight, it would have made sense to start out with a bigger sample.

7.3.6 The ASC sample inevitably comprised a heterogeneous group of children, which made findings difficult to analyse quantitatively due to the large standard deviations and non-parametric distributions of data. Selection of children using the criterion of being at the level of one or two word utterances was discussed with the head teacher of the special schools concerned although, in reality, the range of linguistic abilities was diverse. Future research should specifically test children for linguistic abilities before the onset of the study.

7.3.7 As in any empirical work, there were extraneous variables that may have significantly affected the data. One problem was that the scoring did not take into account how children were feeling on the day. One participant whose score for verbal recall in the words-only condition was only 9%, subsequently scored 90.5% in the words-and-music condition. Looking back at the video of the learning session for the words-only condition, we note that this participant was able to repeat some of the words correctly from the piece being played one line at time. However, after then being asked to repeat the piece in its entirety, having listened to it played all the way through, the participant told the researcher, 'I've got a cold'. Furthermore the

teaching assistant had to ask him on more than one occasion to cover his mouth when coughing, and on numerous occasions when listening to the piece being played back, he was clearly not concentrating. It is thus not easy to ascertain whether the enhancing effect music may have had on verbal recall for this participant was simply because, at the time of learning in the music-and-words condition he was more attentive. In terms of limitations of the method used in this study, such extraneous variables could not be controlled for.

- 7.3.8 There were no measures to analyse the extent to which participants in the ASC group understood the words they could recall across the phases and conditions of this study. It is possible that some children were processing words as sound with little or no understanding. Although scores obtained were marked for semantic content, there was no measure to ascertain whether material recalled was fully understood, as even if recalled material ‘made sense’ it is not clear whether participants were recalling material on a purely phonetic basis. It would be interesting to explore how the recall of material from both working and long-term memory may be affected by a child’s understanding of the words.

7.4 Suggestions for future research

7.4.1 To generate a more effective musical curriculum for children with ASC, and to maximise the potential benefits that music can have on wider learning and development (particularly language and communication), there is a need for future research to assess the relationship between music and language for children with ASC. Exploring the issues as described below might facilitate the attainment of this goal.

- Future research should focus on the extent to which children with ASC understand words they learn from songs. The design of empirical studies should incorporate material to ascertain the extent to which words learnt from songs are understood by children with ASC through a series of short, simple questions.
- Future research should attempt to recruit groups of children with ASC who are at similar levels of linguistic development in the hope of obtaining data that are normally distributed, so as to allow the application of inferential statistical tests to ascertain the generalisability of results.
- Future research should attempt to assess the musical abilities of children with ASC more accurately.
- Future studies attempting to ascertain the effects of music on language for children with ASC should assess how types of musical activities other than singing impact on language and communication for this population.
- With regard to ‘typically developing’ children, different genres of song should be incorporated within the design of studies in order to gauge the impact that different types of music may have on verbal recall in both working and long-term memory, particularly for children in the transitional phase between KS1 and KS2.

7.5 Contribution to knowledge

7.5.1 Findings from this research have contributed to knowledge in the following ways:

- This study has contributed to knowledge by analysing the effect of singing on verbal recall using a novel approach developed from zygonic theory.
- The study has provided evidence to suggest that the level of linguistic development affects the impact that music will have on language learning for children with ASC. This has implications for practitioners and policy-makers, in terms of the need to be aware of the type of music-educational provision that children at different ages and stages require.
- With regard to the effect of language on learning music, this study is the first to suggest that the level of a child's musical ability has an impact on the effect that the presence of words has on music.
- Data from the questionnaire have identified differences between parents and teachers with regard to their perceptions of children's musical and linguistic abilities. This highlights the need for greater communication between parents and teachers so as to maximise the beneficial impact music may have on language for some children with ASC.

7.6 Conclusion

- 7.6.1 To conclude, findings from both the questionnaire and the comparative intervention show that music can have a range of effects on children with ASC. For some children, music will have a positive effect on language learning, for others a negative effect and for others still, no effect at all. Such a finding is indicative of the ‘uniqueness’ of children with ASC, and the danger of regarding children with ASC as an homogeneous group, in the expectation that a given type of musical activity will have a universal effect.
- 7.6.2 With regard to the central hypothesis ‘The co-existence of music and words may facilitate language and music learning and utilisation for children with ASC’, my findings suggest that the impact of music on verbal recall is dependent upon the level of a child’s linguistic ability. Similarly, the effect language can have on melodic recall is dependent on a child’s music-developmental level. It would seem that music has the greatest impact on language learning for children with some language delay (as opposed to non-verbal children, or children with age-appropriate speech).
- 7.6.3 With regard to the second hypothesis, ‘The extent to which the co-existence of music and words may facilitate language learning and utilisation will be more evident for children with ASC, when compared to neurotypical children’, findings from the comparative intervention show that the extent to which the co-existence of music and words may facilitate language learning and utilisation is greater for

children with ASC with some language delay than for neurotypical children at the level of KS2, but not necessarily at the level of KS1.

- 7.6.4 It is not clear why music may enhance language learning for some children with ASC, although three possible reasons have been discussed here. Firstly, music and language may share neurological resources, and that exposure to and involvement in music might increase the connectivity of the neural networks involved in the encoding of language. Secondly, the presence of music, or singing as opposed to speaking, may have an arousing effect within the autonomous nervous system. Finally, due to the unique way in which some children with ASC process auditory stimuli, they may have a natural affinity with music; thus, through a process of association, words have a higher (or more coherent) perceptual profile when linked to melody. A combination of all three of these effects may explain why music can augment language learning for some children with ASC.
- 7.6.5 Ultimately however, regardless of how the process works, these findings provide evidence to show that singing can enhance verbal recall for some children with ASC, and, as such, strengthen the claim that music should play a central role in autism spectrum curricula.

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Appendix1

Ethical Approval.

“The research for this project was submitted for ethics consideration under the reference,
‘The effect of music on intelligible speech production for children with autism, in the
Department of Education, and was approved under the procedures of the University of
Roehampton’s Ethics Committee on 1/11/2012”.

ETHICS**APPLICATION FORM**

Please read the Notes for Applicants before completing this form

The form should be word processed using black size 12 font.

PLEASE TICK THE RELEVANT BOX

MEMBER OF STAFF

☐

RESEARCH STUDENT*

☐

(MPhil, PhD, EdD, PsychD)

EXTERNAL INVESTIGATOR

☐

STUDENT (Other)**

☐

*If you are a transfer student please see Section 2.2. of the Guidelines before completing this form.

**If you are on a taught course you do not need to complete this form unless your project is worth more than 50% of your total credits or you have been asked to do so by your tutor or School Ethics Committee

SECTION 1: PERSONAL DETAILS

Please complete the header with your name and School

Name (lead):

Adam Reece

Other investigators:

Correspondence address:

9 Wainsway Perranporth Truro TR60HA

Telephone no:

Email: (all correspondence will be sent by email unless otherwise requested)

adamreecemusic@yahoo.com

FOR STUDENTS ONLY:

Programme of study:

PhD School of Education

Mode of study (full-time/part-time)

Part time

Director of Studies:

Supervisor – Adam Ockelford

(If you are on a taught course please give the name of your tutor)	
FOR EXTERNAL INVESTIGATORS ONLY (please see Section 4.5 of the Ethical Guidelines):	
Name of Academic Assessor:	
SECTION 2: PROJECT DETAILS	
Title of project:	The Effect of Music on Intelligible Speech Production for Children with Autistim.
Proposed start date: <i>(Please note it can take several months to get approval. The Board will not approve a retrospective start date)</i>	August 2010
Duration:	16 months
Source of funds:	Currently self funded
Purpose of the proposed investigation : This section should include the material which outlines the rationale for the project, i.e. why this study needs to be done. This should be done in a way that is both accessible and scholarly, i.e. have proper cited sources.	

Purpose of the Proposed Investigation

Through my work in home, school, or day care settings, I have witnessed first-hand how involvement in different types of musical activities has been beneficial in terms of communication for individuals with autism, especially with regard to the enhancement of intelligible word production through language in song. It is not immediately apparent how much of such language is understood by the child concerned, or how much the process could develop necessary skills in order to enhance the expressive use of language in other contexts. Thus the focus of this research is to analyse the impact music has on speech and language for individuals with autism, and to analyse the process through which exposure to or involvement in certain types of musical activities could enhance communication skills for individuals with autism.

Much of the past research on the ways in which music therapy can enhance behavioural and communication skills for individuals with autism, has tended to focus on the effects of improvisational music therapy, and dependent variables have often been measures of joint engagement. Few studies have been carried with a focus on enhancement of speech through development of language in song, or in essence, whether the language used through song is beneficial to everyday communication. Furthermore, little research has been carried to address the extent to which individuals with autism are 'semantically aware' of the language they use in the context of a song.

The aim of this study is to provide evidence to support the central hypothesis that the association of words with music will make the words easier to produce for

children with ASD, and to ascertain the extent to which language learned through song can cross over to other non- musical contexts.

The objectives are:

To address the research questions relating to the central hypothesis, that the association of words with music will make the words easier to learn and produce for children with ASD, and to compare this with findings from their 'typically developing' peers.

To assess the impact words have on music production for children with ASD and to compare this with their 'typically developing' peers

To assess the extent to which language learned through song is understood by the children involved

To assess whether language learned through song is transferable to other non musical contexts

Outline of project:

This section should include the details of methodology i.e. what will be done and how. Please also identify ethical issues raised by the project.

Outline of project:

In the first phase of this study, I will be carrying out semi-structured interviews with parents and teachers of children with autism. These preliminary interviews will be conducted with six teachers and six parents or carers. The reasons I will be carrying out these semi structured interviews, is in order to gain some information on how (if at all) parents, teachers or carers may have noticed that exposure to different types of music, or involvement in different types of musical activities, might enhance the children's communication skills, with an emphasis on intelligible word production, or non verbal vocalisation. I have chosen to carry out interviews because conceivably this could produce a rich source of data from a relatively small population, that could then be refined into questions on a questionnaire form, which could be sent out to a much larger population.

Although the preliminary interviews could in some ways complement the questionnaire, predominantly the interviews will be carried out to identify and to refine the questions for the questionnaire form. The interviews will last around half an hour. The reason for this is so as to gain enough information to help formulate more specific questions for the questionnaires, whilst at the same time not imposing too much of a time constraint on the parents or carers.

To a degree, responses from the semi structured interviews will have an impact on the questions to be included in the questionnaire forms. Questions will grow from the interviews in the following ways.....

- 1 Questions can be formulated to test the extent to which interview responses may be generalised
- 2 Unexpected responses from the interviews can be used to formulate new questions
- 3 Any patterns to emerge from responses to the interviews can be tested through inclusion of questions to specifically address such issues
- 4 Questionnaire responses should address more 'specific' aspects of the ways in which music can impact upon communication
- 5 Questions can be formulated to test 'validity' of interview responses

The questions will be both open ended and closed ended. Closed questions will be both ordered and unordered.

Empirical Work

The third phase of this study, the empirical phase, will involve 30 ASD students and 30 'neuro typical' primary school children. I will be writing three simple pieces, which will contain no material which could cause offence. These pieces will be in the format of a simple children's song, and this song will be presented to the participants in three different conditions:

Words and music

Words only

Music only

Participants will listen to the three different songs, in one of the three conditions, and then activities will be carried out to ascertain how much of the language, and how much of the melody they can learn and reproduce. The conditions will be 'live' as opposed to recorded, and music will consist of live piano or keyboards –in the event of no piano being available.

One of the three pieces will be played to the participants twice, across the different conditions. Participants will then be involved in activities relating to the session involving repeating back the words or music, recognising sections of music, or recognising themes related to the contents of the session. Responses will be analysed in terms of accuracy, mean number of mistakes, mean utterance, intensity and length of joint engagement, and eye contact. Hopefully such data could help to establish the impact (if any) music has on participant's production of intelligible words, the impact the words have on participants repetition of melody, and the extent to which words learned through song could be transferable to other non musical contexts.

Participant	Words/Music	Words	Music
1 -10	Piece1	Piece2	Piece3
11-20	Piece3	Piece1	Piece2
21-30	Piece2	Piece3	Piece1

Up to N =30

Ethical Issues

There are certain ethical issues involved in carrying out research of this nature, especially with regard to working with young children, and young children with autistic spectrum disorder who have difficulties with language and may not have enough understanding to know what is happening to them.

Consequently, the researcher will ask the teachers and parents at the schools and organisations involved to explain to the participants as far as is possible, the nature of this project. According to the individual needs of each students additional strategies can be used such as the PECS-Picture Exchange Communication System, www.pecs.com, - or Makaton, www.makaton.org to help the participant become more aware of the proceedings involved in the carrying out of the empirical phase of this study. Individual professionals who work with the children will be asked to note and inform the researcher, if the children are thought to have a negative reaction to engagement in the activities. In addition, parents will be provided with written information regarding the aims of the study and the data collection process. They will also be informed of their right to withdraw the child at any time, and they will also be asked to give full consent for the participation of their children in the research.

As mentioned above, the sessions will be video recorded. As a result, children's faces might be clearly visible and therefore identifiable to the researcher, the supervisors of the study and external examiners of the study. Because of this, the video will not be used in any presentations or conferences in which this study might be included, and consequently, the video will be destroyed after completion of the study. All participants and their primary carers have the right to withhold permission. The researcher will ensure that no child is identifiable unless permission has been given.

All results will be reported honestly and precisely. Publication of results will comply with the Data Protection Act, 1998. All participants' information will be carefully protected. No names will be attached to either the video-recordings or the interviews. Names of the participants will be changed to protect individual's identity and ensure anonymity. If a child becomes distressed at any stage, the researcher will stop the session and seek to reassure the child. If distress is not reduced the researcher will ask the teacher, carer, or learning Support Assistant to withdraw the child either from the activity, the session or from the whole procedure. At no time will the researcher be carrying out sessions with an unattended child.

The researcher will strive to design activities within the empirical phase, in a way that will be pleasant, enjoyable and in some aspects beneficial for all participating groups.

SECTION 3: USE OF PARTICIPANTS

- You should download the Participant Consent Form Template and amend it if necessary
- You should also attach any other information to be given to participants
 - You should consider carefully what information you provide to participants, e.g. scope of study, number of participants, duration of study, risks/benefits of the project. It is recommended that the participant has two copies of the consent form so they can retain one for information.
 - If images or anything else which might allow the identification of participants is to be publicly accessible (e.g. on the web), further written consent must be secured

Method of Recruitment

In the first phase of my study, which will consist of carrying out semi-structured interviews, I will be working with 6 teachers and six parents. The teachers will be recruited from Doubletrees School, a special school for children with learning disabilities in Mid Cornwall, and also from the 'Spectrum' organisation, a charity that looks after individuals with Autistic Spectrum Disorder throughout Cornwall. From mentioning my research to the teachers at Doubletrees and at Spectrum, at least six teachers have shown interest in participating in the semi-structured interviews, and at no time has any pressure been placed on them to participate in this research. Parents of the children with autism that I have been teaching at Doubletrees School will be recruited through a letter distributed to their home. The letter will contain information on the nature of the research and how it will be carried out. Furthermore, issues of confidentiality will be fully explained and the parents will be informed of their right to withdraw from the interview, the research, and have any collected data deleted from the study at any point in time. Issues of anonymity will also be outlined in the letter to the Parents. No individual child or family will be identifiable and no data will be presented in a critical or judgemental way. Throughout the research all individuals will be referred to by number, the identity of which is known only to the researcher. Interviews will be recorded onto a mini disc, and then transferred into WAV files and stored on a password protected PC. Mini disc recordings will subsequently be erased.

In the second phase of the research Questionnaires will be sent to parents and teachers, resulting in data from 100 completed questionnaires, which will include responses from 50 parents and 50 teachers. As the number of completed questionnaires approaches the desired target, in the final stages it may be appropriate to recruit for *just* parents or *just* teachers, so as to guarantee equal numbers of both parents and teachers participate. The purpose of the questionnaire will be clearly defined to all participants so as to explain as fully as possible what the project is about, and why it is being undertaken. No parent or teacher will receive a questionnaire unless they have expressed an interest in participating in this research. Initially, the questionnaire will be mentioned in circular letters and news type letters distributed throughout different schools and organisations throughout the south west of England, and parents and teachers will be required to contact the relevant institution or organisation to receive a questionnaire. The questionnaire will be presented in such a way that the right of the participant not to enter is made clear, and that he or she may at any stage withdraw themselves and their data from the research. The information from any individual questionnaire or interview shall

remain confidential and the anonymity of the respondents shall be preserved. I will be distributing questionnaires through Doubletrees School, as well as Curnow School, Pencallenick and Nancevean, all special schools based in Cornwall. I will also be distributing questionnaires through the Spectrum organisation, the charitable based organisation for clients with ASD based throughout Cornwall.

With regard to the empirical phase of this study, I will be working with 30 autistic students from either: Doubletrees School, Kernow School, or clients from within the Spectrum organisation. I will also be working with a control group of 30 participants from either St Marys Nursery, St Marys primary school or Pen-air secondary school, all based in Truro, Cornwall. With regard to both conditions-ie both the autistic children and the children within mainstream education- I will consulting with teachers to ascertain which pupils would be suitable to participate in the music activity sessions, ensuring no children are involved who could find participation in these activities stressful in any way. Such consultation will take place before any of the sessions take place. As the children will not be able to give 'informed consent,' before any sessions take place, I will be discussing with the teachers with regard to to look for any signs of distress or unusual behaviour displayed by any of the children involved.

Teachers and parents involved in this study may benefit from taking part in this study through an increased awareness of the potential power of music to enhance their child's abilities to communicate more effectively. The children who participate in the research will benefit from an enjoyable experience through their participation in structured musical activities.

Will you be using participants who are aged under 18? **Yes**

If you have answered Yes please refer to section 4.11 of the Ethical Guidelines and highlight the particular issues raised by working with these participants and how these issues have been addressed.

Because the research involves young children, and specifically young children with special needs who might have difficulty with language and communication, it is acknowledged that certain ethical issues are involved. The researcher will always strive to use language at an appropriate level, and in the case of non verbal participants will ask for specific advice from teachers or carers in terms of the best way to communicate, so as to cause the minimum amount of stress for that particular participant.

There will always be at least one other person present (parent, carer or significant other) at any stage of this study, as all participants involved will be under the age of 18. Furthermore before any session with any individual participant takes place, any ways in which the participant displays signs of stress, or any indication of unusual behaviour, will be discussed with teachers or carers beforehand. Further to this I have an enhanced CRB certificate of clearance from Spectrum, Cornwall County Council, Truro College Special Needs Group, and the University of Manchester.

SECTION 4: HEALTH AND SAFETY

I will endeavour to take all necessary precautions with regard to the use of video camera and equipment throughout the empirical phase of this research. At no time will the video recording equipment be unattended throughout the activities to be included within the empirical phase of the research. Furthermore, only equipment which has been subject to University PAT procedures will be used. Any wires or cables will be taped down to the floor to avoid any danger of any people involved in the activities tripping, and all equipment will be secured at all times. I will make the necessary arrangements to ensure that the room selected for the sessions will be accessible to all participants, and that the furniture will be arranged in such a way that the risk of any participant bumping into ,or falling over any furniture shall be minimised.

All parents of participants in this research will be informed that the empirical sessions will be recorded by a hand held video camera. Identity of any of the participants recorded on video will only be known to the researcher. All participants will be referred to numerically and not by name. The video will only be seen by the researcher, the supervisors of the study and external examiners of the study. At no time in the future, in any conference or presentation relating to this study, will any video footage be shown. Video footage will be transferred to a pass word protected PC, and will only be accessible to the researcher.

Will any of your project take place outside the UK?

NO

If you have answered yes please list the countries below and refer to Section 4.2 of the Ethical Guidelines:

Is this a clinical trial or a project which may involve abnormal risk to participants?

NO

If you have answered Yes please refer to Sections 3.5 and 4.2 of the Ethical Guidelines

SECTION 5: PUBLICATION OF RESULTS

How will you disseminate your findings? (e.g. publication)

The results of this research will be written up as a doctoral thesis, and could be further edited to be included in academic journals or conference papers. No individual, family, schools or organisation should be identifiable through any published works. All names will be changed in order to protect personal information. No images which permit identification of any participant or school or organisation will be included in any publication or presentation. Videos will only be seen by the researcher, supervisors of this study and external examiners of this study. There will no instances of any information being used or presented in a judgemental way. An executive summary of the data will be given to the schools, who will make it available to parents on request.

<p>How will you ensure the anonymity of your participants? (If your participants do not wish to remain anonymous you must obtain their written consent.)</p> <p>The names of any participants at any stage of this research will not be disclosed or made public and remain known only to the researcher and other professionals involved on a daily basis through their usual duties. In all stored data, participants will be referred to numerically or pseudonyms will be used. There will be no need at any stage to reveal the names of any participants. Videos will only be seen by the researcher, the supervisors and the external examiners of this study. Videos will be digitally recorded and files will be converted and stored on a pass word protected PC. Any clips to be shown in the context of an academic conference will be separately approved by the school involved.</p>

<p>SECTION 6: STORAGE OF DATA</p>
<p>Section 2.7 of <i>Roehampton University Code of Good Research Practice</i> states the following 'research data must normally be retained intact for a period of at least ten years from the date of any publication which is based upon it. Researchers should be aware that specific professional bodies and research councils may require a longer period of data retention.'</p>
<p>Describe how and where the following data will be stored and how they will be kept secure:</p> <p>Raw and processed data</p> <p>Any digital recordings of the semi-structured interviews throughout the first phase of the study, will be saved as MP3s and stored on my home computer. This will be pass word protected, with the pass word only being available to the researcher.</p>

Any hard copies of either mini –discs, or video tape, or field notes will be kept in a locked drawer in the researcher’s office, and the researcher will be the only holder of the key. Extra care will be taken when transporting data between schools and organisations, the University and the researcher’s home, in that data will be concealed in a locked briefcase, to ensure nature of the contents are not accessible to any third party.

Questionnaire responses will be personally returned to the researcher’s home address and filed at home in a locked drawer.

Any information and analysis of the empirical phase of this study will be stored on my computer at home, which will again be password protected.

Documents containing personal details of any participants

All data will be saved in two different databases. Documents containing personal information and contact details of participants, and, also any personal data, will be stored at a separate database, which will be accessible only by the researcher on a password protected PC. A reference number will be used in the accessible database.

SECTION 7: EXTERNAL GUIDELINES, APPROVAL & FUNDING

Are there any relevant subject-specific ethical guidelines (e.g. from a professional society)? This research will comply with the BERA Ethical Guidelines for good professional conduct and statement of ethical practice.

If so how will these inform your research process?

Specific reference is made to undertaking research with vulnerable individuals whose age, intellectual capability or other vulnerable circumstances may limit the extent to which they can be expected to understand or agree voluntarily to participate. In compliance with the BERA guidelines the research will seek approval of parents and also use alternative ways of enabling communication with the participants.

Has/will the project be submitted for approval to the ethical committee of any other organisation, e.g. NHS ethics approval? (Please see Section 4.3, Ethical Guidelines)

No

What is the outcome of this?

Is your project externally funded?

No

If you have answered yes you must complete a P1 form and submit this to the Bids & Grants Team, RBDO before you complete your ethics application.

Has your P1 form been approved?

No

Please state the name of the funding organisation/company below and provide any other relevant information:

SECTION 8: APPLICANT'S SIGNATURE	
Applicant's signature:	Adam Reece
Date:	31/5/2010
FOR STUDENTS ONLY: DIRECTOR OF STUDIES SIGNATURE (Where there is not a Director of Studies this should be completed by the academic supervisor)	
<i>I confirm that I have read and support this Ethics Application</i>	
Signature:	Adam Reece
Print name:	Adam Reece
Date:	31/5/2010

Appendix 3

Standard letter to request respondents to fill in questionnaire

Dear Sir /Madam

I am currently a PhD candidate at the University of Roehampton (London UK) under the supervision of Professor Ockelford. My thesis is focusing on how music can enhance speech production and understanding for children and young adults with ASD. As part of this research there is a questionnaire for parents, teachers, carers and music therapists, available at

www.surveymonkey.com/adamreecemusic

The questionnaire is for parents, teachers, carers and music therapists involved with young people with autism. It should not take more than a couple of minutes to fill in, and looks at the role of music in the lives of children and young adults with ASD, and the affect music might have on communication for this population.

Any help whatsoever with obtaining responses for this questionnaire would be very much appreciated!! When filling out the questionnaire, responses should be made which relate to one individual person, as opposed to people with ASD in general.

Many thanks

Adam Reece

Appendix 4

Letter to obtain parental permission for children to participate in the empirical observation



Dear Parent,

I taught music at Doubletrees School from January to July 2010. I am now undertaking a degree at Roehampton University in London, looking at the relationship between autism, music and language.

The practical phase of my research will involve 30 children with autism, and thirty typically developing children. Activities will be carried out either with words and music, with words alone, or with music alone, to look at the effect of music on the children's speech and communication skills, in an attempt to establish how the presence of music can enhance the children's production and learning of spoken language. This letter is to ask whether it would be possible for your child to take part in this research.

Sessions would last for thirty minutes and each child would participate in three sessions. One session would involve words and music, one session would involve just words, and one sessions would involve just music. The children would be tested on their ability to recall and produce either the words, or the music in each session.

Sessions would take place at your child's school. All sessions would be digitally recorded with a hand held video camera, and all recordings would be kept on a password protected PC. All the information I gather will remain completely anonymous.

If you have any questions now or in the future regarding the research, then please do get in touch. Or you can speak to my supervisor, Professor Adam Ockelford, on 07818 456 472, email a.ockelford@roehampton.ac.uk

Yours sincerely

Adam Reece

telephone 07905306549: email adamreecemusic@yahoo.com

I am the parent of (please print) ----- and I
would be interested in taking part in the music language and autism research

Date -----

Name

Signature

Telephone -----

e mail -----

Appendix 5

Letter to head of Special School



FAO Head Of School

Adam Reece
9 Wainsway
Perranporth
Truro
TR6 0HA

Tel: 07905306549

Email: adamreecemusic@yahoo.com

Dear Sir/Madam,

I taught music at Doubletrees School from January to July 2010. I am now undertaking a degree at Roehampton University in London, looking at the relationship between autism, music and language.

The empirical phase of my research will involve 30 children on the autism spectrum and 30 without SEN. It will involve working with children in groups of 6, teaching them short pieces of music and a poem. This letter is to ask for permission to carry out these sessions at your school, working with pupils with Autistic Spectrum Disorder. Sessions would last for thirty minutes and each child would need participate in three sessions, over a period of three weeks.

All sessions would be digitally recorded with a hand held video camera by one of the teachers or care assistants who will be accompanying me throughout the sessions. All recordings would be kept on a password protected PC. All the information I gather will remain completely anonymous.

If you are at all interested in this research, then I would be pleased to come up to the school and talk to you in person, and, with your consent, to also draft a letter to the parents of the children asking permission for their children to participate in this research. I would also with your consent like to write to the teachers of the children to ask them if they would be able to help supervise any sessions being carried out at the school.

If you have any questions now or in the future regarding the research, then please do get in touch. Or you can speak to my supervisor, Professor Adam Ockelford, on 07818 456 472, email a.ockelford@roehampton.ac.uk

Yours sincerely
Adam Reece

Appendix 6



Letter to Head of Mainstream primary school

FAO Head Of School

Adam Reece
9 Wainsway
Perranporth
Truro
TR6 0HA

Tel: 07905306549

Email: adamreecemusic@yahoo.com

Dear Sir/Madam,

I taught music at Doubletrees School from January to July 2010. I am now undertaking a degree at Roehampton University in London, looking at the relationship between autism, music and language.

The empirical phase of my research will involve 30 children on the autism spectrum and 30 without SEN. It will involve working with children in groups of 6, teaching them short pieces of music and a poem. This letter is to ask for permission to carry out these sessions at your school, working with pupils without SEN. Sessions would last for thirty minutes and each child would need participate in three sessions, over a period of two weeks.

All sessions would be digitally recorded with a hand held video camera by one of the teachers or care assistants who will be accompanying me throughout the sessions. All recordings would be kept on a password protected PC. All the information I gather will remain completely anonymous.

If you are at all interested in this research, then I would be pleased to come up to the school and talk to you in person, and, with your consent, to also draft a letter to the parents of the children asking permission for their children to participate in this research. I would also with your consent like to write to the teachers of the children to ask them if they would be able to help supervise any sessions being carried out at the school.

If you have any questions now or in the future regarding the research, then please do get in touch. Or you can speak to my supervisor, Professor Adam Ockelford, on 07818 456 472, email a.ockelford@roehampton.ac.uk

Yours sincerely
Adam Reece

Q.1 Gender

☐ ☐ female
Gender male

Q.2 Nature of Special Needs**Q.3 How would you describe the level of your child's speech? (please tick one or more of the following)**

- ☐ Nonverbal
☐ Uses words singly or in pairs
☐ Echolalic (copies words he/she hears with little apparent understanding)
☐ Speaks at a a level you would consider appropriate for his or her age group

Q.4 How would you rate your child's understanding of language? (Please tick one or more of the following)

- ☐ Little or no understanding
☐ Some understanding but not at a level you would consider appropriate for his or her age group
☐ Understands language at a level you would consider appropriate for his or her age group

Q.5 Does your child sing?

- ☐ Yes
☐ No

Q 6 How many hours per day, on average?

- ☐ Less than 1
- ☐ 1-2 hours
- ☐ 3 or more hours

Question 7 How good is his or her singing?

- ☐ Not as advanced as you would expect for a child of her/his age
- ☐ About what you would expect for a child of her/his age
- ☐ More advanced than you would expect for a child of her/his age
- ☐ Don't know

Question 8 Does your child have absolute pitch? (for example, does your child know the names of musical notes just by listening to them, or does he/she always sing pieces in the same key?)

- ☐ yes
- ☐ no
- ☐ don't know

Question 9 Does your child ever sing without words (humming, 'lah-ing' or whistling, for example)?

- ☐ always
- ☐ sometimes
- ☐ never

Question 10

Have you noticed any instances where your child has learnt a word in a song and applied that word in a real-life situation?

- ☐ yes
- ☐ no

Question 11

Do you ever use songs to try to help your child understand or use language?

☐ yes

☐ no

Question 12 Does your child ever sing to express emotion, to express needs, or to make specific requests?

☐ yes

☐ no

Question 13

To what extent would you say engagement in music has helped your child develop relationships with other people? (For instance helping the child to become more aware of another person's actions, or motivating a child to join in shared activities over time?)

☐ not at all

☐ a very little

☐ somewhat

☐ a lot

☐ very much so

☐ don't know

Contact Details

Contact
Details relationship to
individual

Name

Address

Phone

E mail

Date